

2004 Chevrolet Blazer

2004 BRAKES Anti-lock Brake System - Blazer/S10, Jimmy/Sonoma

2004 BRAKES

Anti-lock Brake System - Blazer/S10, Jimmy/Sonoma

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
EBCM to BPMV	5 N.m	39 lb in
EHCU to Bracket	9 N.m	7 lb ft
Front Brake Lines to BPMV	30 N.m	22 lb ft
Master Cylinder Brake Lines to BPMV	24 N.m	18 lb ft
Rear Brake Line to BPMV	24 N.m	18 lb ft
Rear Brake Splash Shield Mounting Bolts	26 N.m	19 lb ft
Steering Knuckle to Front Hub/Bearing Mounting Bolts	180 N.m	133 lb ft
Wheel Speed Sensor Mounting Bolt	18 N.m	13 lb ft

SCHEMATIC AND ROUTING DIAGRAMS

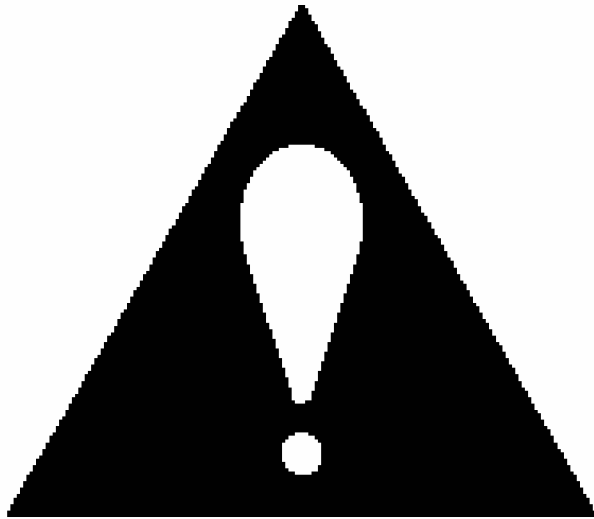
ABS SCHEMATIC ICONS

ABS Schematic Icons

Icon	Icon Definition
	IMPORTANT: Twisted-pair wires provide an effective shield that helps protect sensitive electronic components from electrical interference. If the wires were covered with shielding, install new shielding. In order to prevent electrical interference from degrading the performance of the connected components, you must maintain the proper specification when making any repairs to the twisted-pair wires shown : • The wires must be twisted a minimum of 10 turns per 31 cm (12 in) as measured anywhere along the length of the wires

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- The outside diameter of the twisted wires must not exceed 6.0 mm (0.25 in)

ABS SCHEMATICS

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Fig. 1: ABS Power and Ground Schematic
Courtesy of GENERAL MOTORS CORP.

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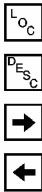


Fig. 2: Class 2 Communication Schematic
Courtesy of GENERAL MOTORS CORP.



Fig. 3: Speed Sensor Signals Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

ABS COMPONENT VIEWS

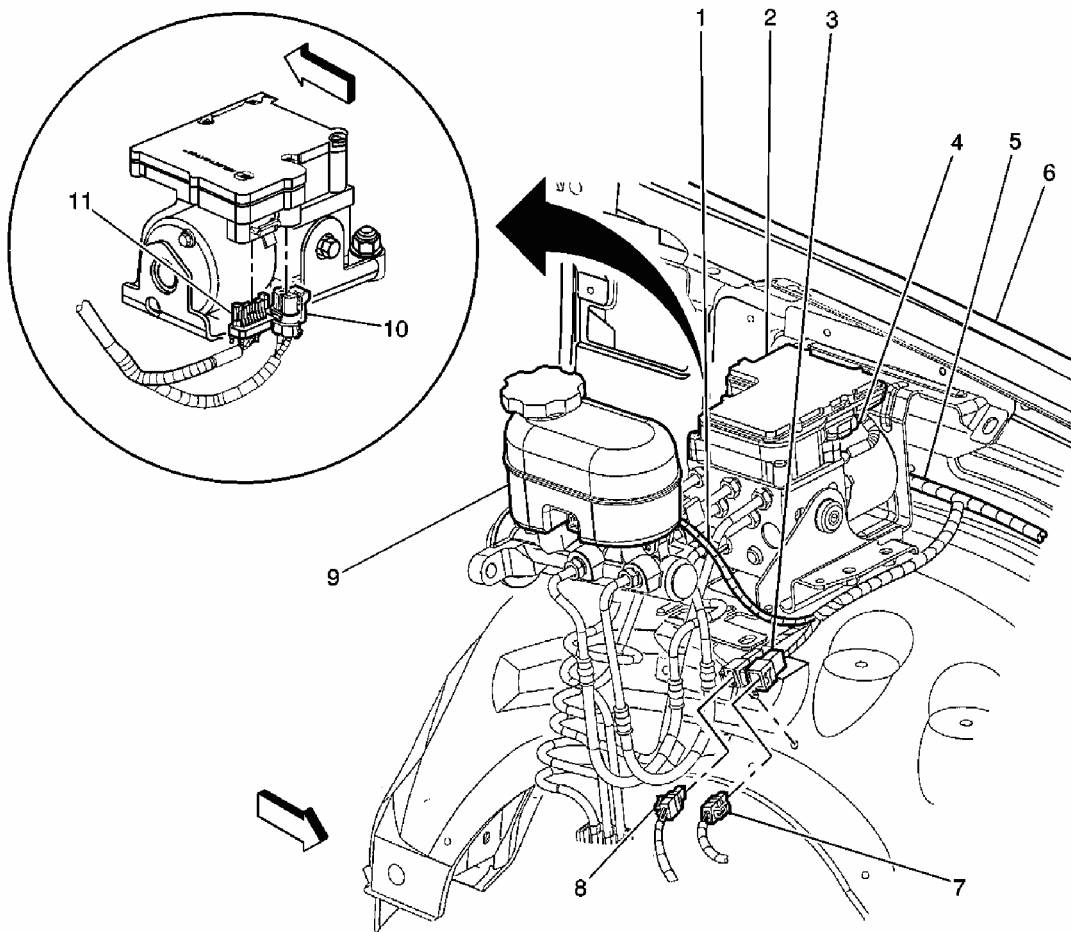


Fig. 4: Electronic Brake Control Module (EBCM)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 4

Callout	Component Name
1	Brake Fluid Level Switch Connector
2	Electronic Brake Control Module (EBCM)
3	C114
4	Pump Motor
5	Body Harness
6	LF Fender

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7	C114
8	C109
9	Brake Master Cylinder
10	Electronic Brake Control Module (EBCM) Connector C2
11	Electronic Brake Control Module (EBCM) Connector C1

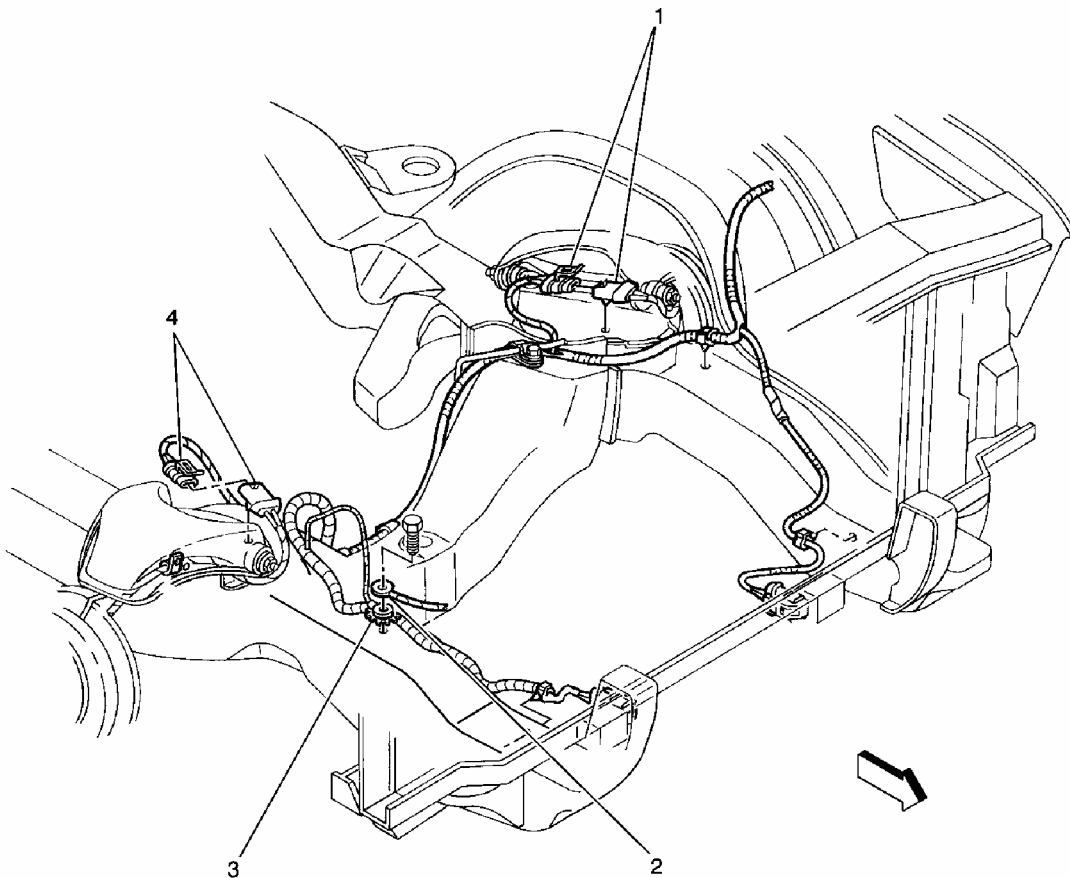


Fig. 5: Forward Wiring Sensor
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

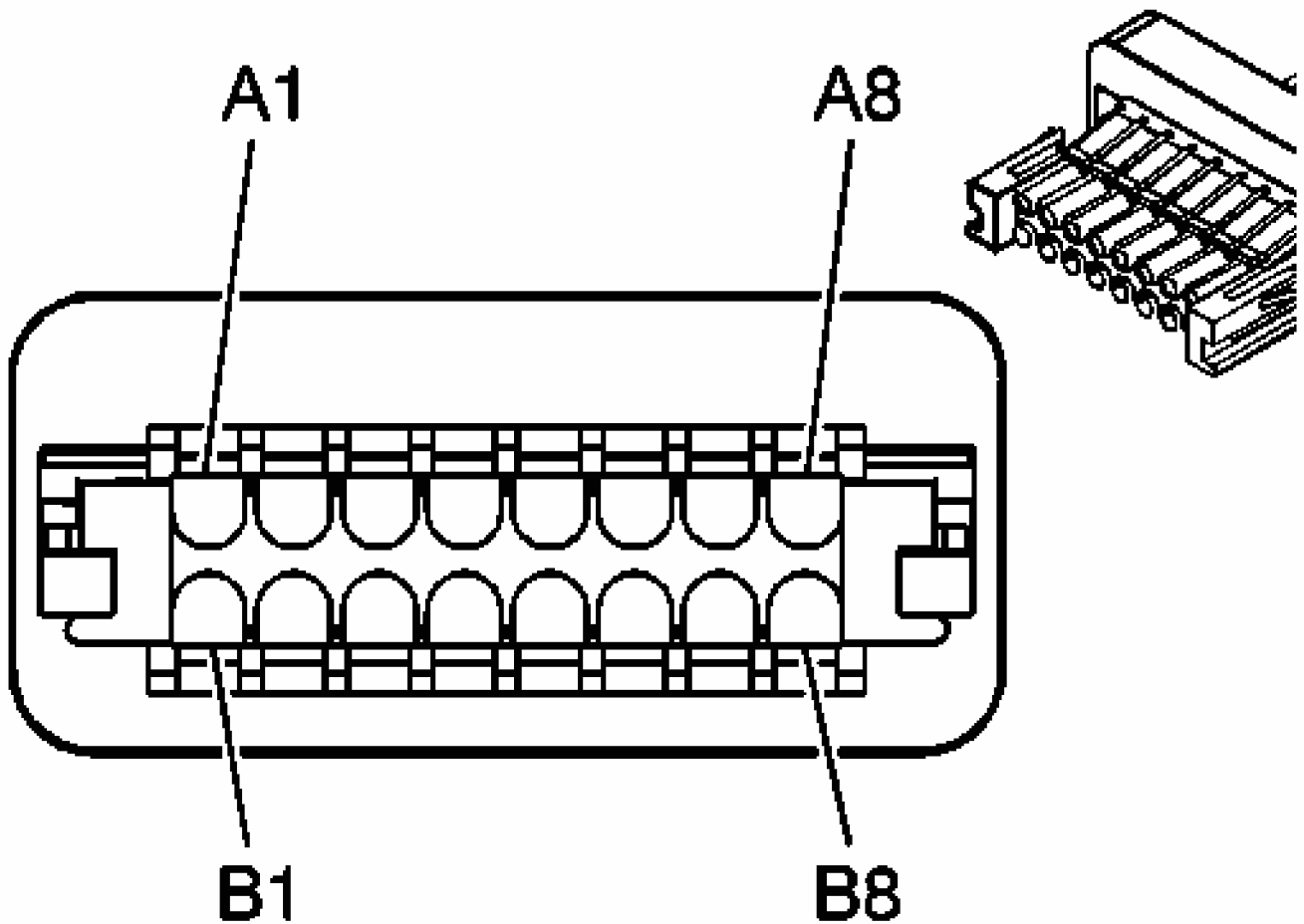
Callout	Component Name
1	Wheel Speed Sensor (WSS) - LF
2	Ground G106
3	Ground G118
4	Wheel Speed Sensor (WSS) - RF

ABS CONNECTOR END VIEWS

Electronic Brake Control Module (EBCM) Connector C1 Connector End View

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Connector Part Information

- 12193519

- 16 Way F Micro-Pack 100 W Series (NA

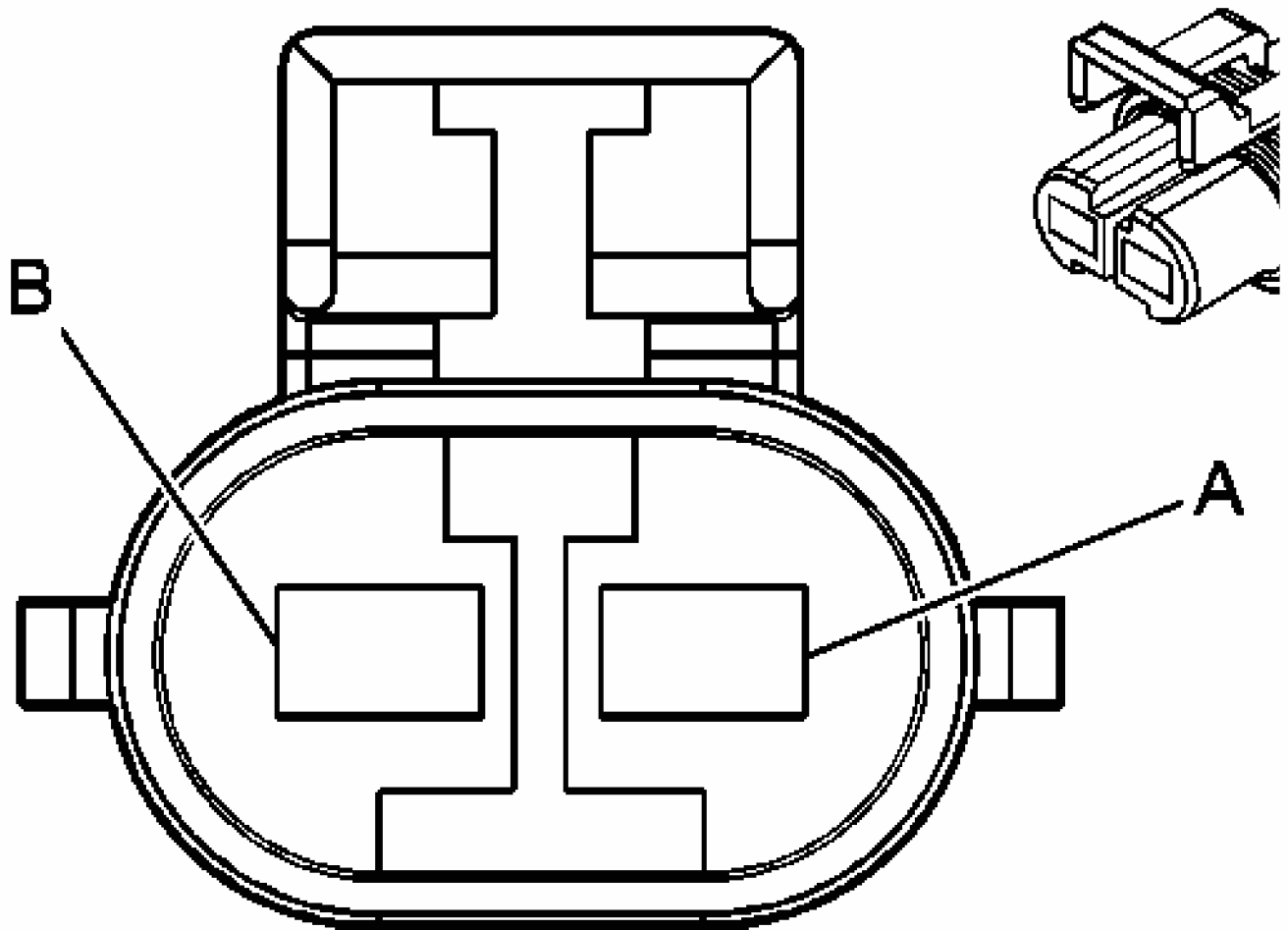
Pin	Wire Color	Circuit No.	Function
A1	BRN	441	Ignition 3 Voltage
	BRN	441	Ignition 3 Voltage (w/L43)
A2	YEL	873	Left Front Wheel Speed Sens
A3	DK GRN	872	Right Front Wheel Speed Sen
A4-A7	-	-	Not Used
A8	BLK/WHT	1695	Axle Switch Signal
B1	YEL/BLK	1827	Vehicle Speed Signal

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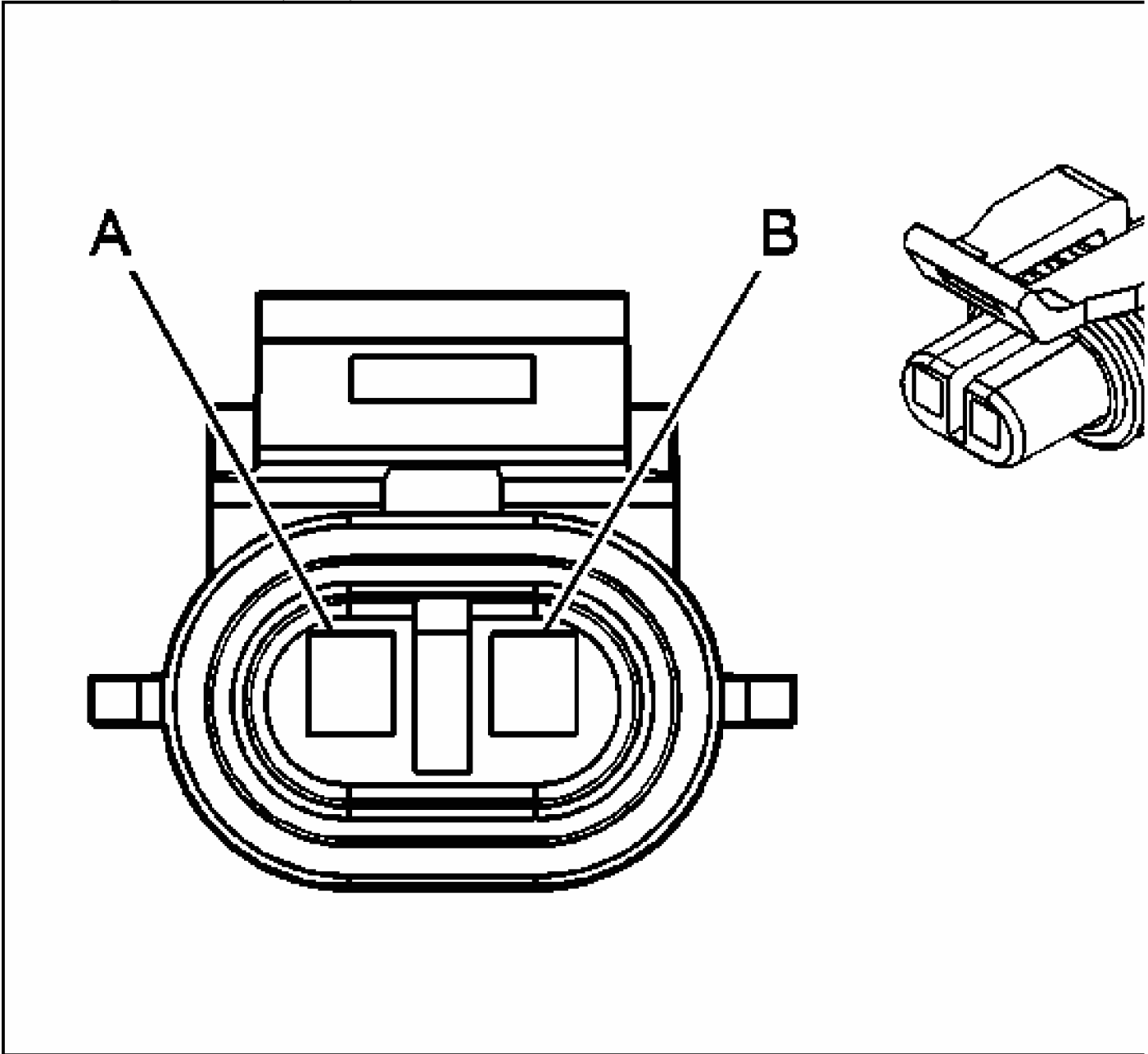
B2	LT BLU	830	Left Front Wheel Speed Sens
B3	TAN	833	Right Front Wheel Speed Sen Reference
B4	-	-	Not Used
B5	PPL	420	TCC Brake Switch Signal
B6	LT BLU	1122	ABS/TCS Class 2 Serial Data
B7	-	-	Not Used
B8	PPL	333	Brake Fluid Level Sensor Sig

Electronic Brake Control Module (EBCM) Connector C2 Connector End View



Connector Part Information		12052613 2-Way F Metri-Pack 480 Series (BLK)	
Pin	Wire Color	Circuit No.	Function
A	BLK	150	Ground
B	RED	442	Battery Positive Voltage

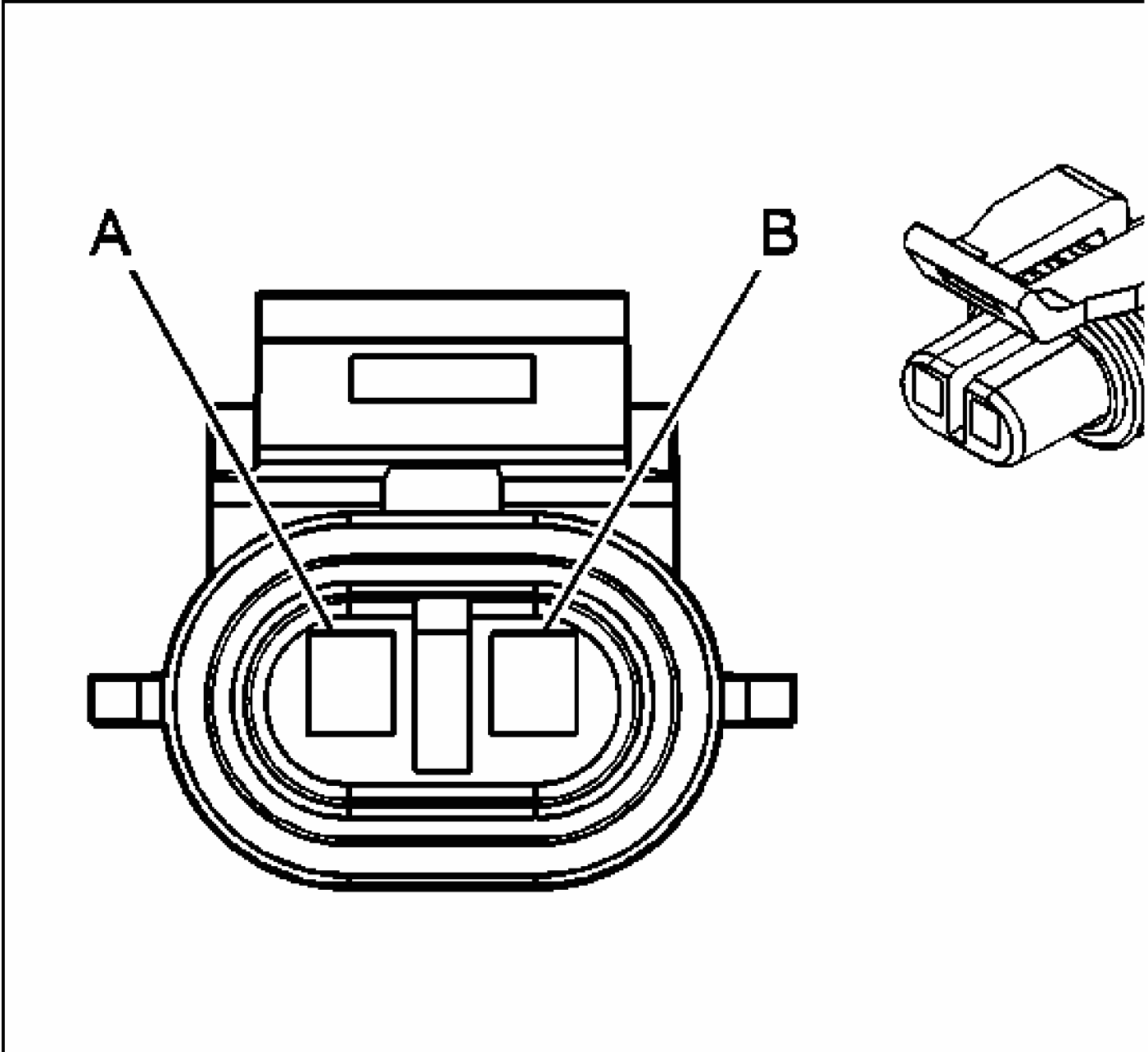
Wheel Speed Sensor (WSS) Connector End View - LF



Connector Part Information		12052641 2-Way F Metri-Pack 150 Series, Sealed (	
Pin	Wire Color	Circuit No.	Function
A	LT BLU	830	Left Front Wheel Speed Sens

B	YEL	873	Left Front Wheel Speed Sens
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Wheel Speed Sensor (WSS) Connector End View - RF



Connector Part Information		12052641 2-Way F Metri-Pack 150 Series, Sealed (	
Pin	Wire Color	Circuit No.	Function
A	TAN	833	Right Front Wheel Speed Sen Reference
B	DK GRN	872	Right Front Wheel Speed Sen

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DIAGNOSTIC STARTING POINT - ANTI-LOCK BRAKE SYSTEM

Begin the system diagnosis with **Diagnostic System Check - ABS** . The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

DIAGNOSTIC SYSTEM CHECK - ABS

Circuit Description

The ABS Diagnostic System Check is an organized approach to identifying problems associated with the ABS. This must be the starting point for any ABS related concern and will direct you to the next logical step in diagnosing a malfunction. Most system malfunctions are linked to faulty wiring, connections and occasionally, to components. Understanding the ABS system and using the diagnostic tables correctly will reduce diagnostic time and prevent unnecessary parts replacement.

Test Description

The numbers below refer to the step numbers in the diagnostic table.

2: Lack of communication may be due to partial or total malfunction of the class 2 serial data circuit. The specified procedure will determine the particular condition.

4: The presence of DTCs that begin with a "U" indicates that some other module is not communicating. The specified procedure will compile all of the available information before tests are performed.

Diagnostic System Check - ABS

Step	Action	Yes	No
1	Install a scan tool. Does the scan tool power up?	Go to Step 2	Go to Scan Tool Does Not Power Up in Data Link Communications
	1. Turn the ignition ON. 2. Use the scan tool in order to establish communication with the following modules: • 4WAL 3 Sensor		

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2	• Powertrain Control Module • Instrument Panel Cluster • Body Control Module Does the scan tool communicate with all of the control modules listed above?	Go to Step 3	Go to <u>Scan Tool Does Not Communicate with Class 2 Device</u> in Data Link Communications
3	Use the scan tool in order to display DTCs for the following control modules: • 4WAL 3 Sensor • Powertrain Control Module • Instrument Panel Cluster Does the scan tool display any DTCs for the control modules listed above?	Go to Step 4	Go to <u>Symptoms - Anti-lock Brake System</u>
4	Does the scan tool display any DTCs that begin with a "U", DTC C0292 or DTC C0297?	Go to <u>Scan Tool Does Not Communicate with Class 2 Device</u> in Data Link Communications	Go to Step 5
5	Does the scan tool display DTC P0500, P0562, P0563, P0601, P0602, P0603, P0604, P0605, P1621, or P1381?	Go to <u>Diagnostic Trouble Code (DTC) List</u> in Engine Controls - 4.3 L	Go to Step 6
6	Does the scan tool display DTC B1367?	Go to <u>Diagnostic Trouble Code (DTC) List</u> in Instrument Panel, Gages, and Console	Go to <u>Diagnostic Trouble Code (DTC) List</u>

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selections	Description
Refer to the Scan Tool Manual for complete scan tool operating instructions.		
		The EBCM commands the system relay.

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Function Test	-	valve solenoids and pump motor ON and OFF. The EBCM sets a DTC if a malfunction is detected.
Automated Bleed	-	The EBCM commands each valve solenoid and the pump motor ON and OFF in a special sequence in order to bleed air out of the BPMV. Refer to <u>ABS Automated Bleed Procedure</u> for a step-by-step procedure.
ABS Motor	-	This function allows the technician to command the ABS pump motor ON and OFF. The EBCM sets a DTC if a malfunction is detected.
System Identification	-	The scan tool displays the hardware and software revision of the EBCM.
Tire Size Calibration	• Read Tire Calibration • New Tire Size	IMPORTANT: The PCM must also be programmed with the correct tire size calibration when different size tires are installed on the vehicle. Refer to <u>Service Programming System (SPS)</u> in Programming. This function allows the technician to read the tire size calibration of the EBCM or calibrate the EBCM to the correct tire size. Calibration must be performed when the EBCM is replaced or when different size tires are installed on the vehicle.
Lamp Tests	• ABS Lamp • Brake Lamp	This function allows the technician to command the ABS indicator or the brake warning indicator ON and OFF.
Solenoid Tests	• Left Front Isolation Valve • Left Front Dump Valve • Right Front Isolation Valve • Right Front	This function allows the technician to command a selected valve solenoid ON and OFF. Use the procedure below in order to verify proper operation of the EBCM and BPMV. Solenoid Test Procedure 1. Raise the vehicle so the wheels are about 15 cm (6 in) off the floor. Refer to <u>Lifting and Jacking the Vehicle</u> in General Information. 2. Select the desired Solenoid Test on the scan tool.

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	Dump Valve • Rear Isolation Valve • Rear Dump Valve	IMPORTANT: Steps 3, 4 and 5 must be performed within a 5 second time period. The EBCM will only energize a solenoid for 5 seconds. 3. Command the solenoid On. 4. Apply the brake. 5. Have an assistant attempt to spin the wheel of the brake circuit being tested. The wheel should spin even though the brake is being applied.
ABS Relay	-	This function allows the technician to command the system relay ON and OFF. The EBCM sets a DTC if a malfunction is detected.

SCAN TOOL DATA LIST

Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON, Transfer Case in 2WD and Brake released			
4WD Status	4WAL 3 Sensor	Two wheel drive/Four wheel drive	Two wheel drive
ABS Lamp Command	4WAL 3 Sensor	On/Off	Off
ABS Pump Motor	4WAL 3 Sensor	On/Off	Off
ABS Relay Command	4WAL 3 Sensor	On/Off	On
ABS Stop State	4WAL 3 Sensor	On/Off	Off
Brake Switch Status	4WAL 3 Sensor	On/Off	Off
Brake Warning Lamp Command	4WAL 3 Sensor	On/Off	Off
Diff. Pressure/Fluid Level	4WAL 3 Sensor	Ok/Low	Ok
DRP Active	4WAL 3 Sensor	Yes/No	No
Left Front Wheel Speed	4WAL 3 Sensor	km/h or mph	5 km/h/3 mph
LF Dump Valve Command	4WAL 3 Sensor	On/Off	Off
LF Dump Valve Feedback	4WAL 3 Sensor	On/Off	Off
LF ISO Valve Command	4WAL 3 Sensor	On/Off	Off
LF ISO Valve Feedback	4WAL 3 Sensor	On/Off	Off
Rear Dump Valve Command	4WAL 3 Sensor	On/Off	Off
Rear Dump Valve Feedback	4WAL 3 Sensor	On/Off	Off
Rear ISO Valve Command	4WAL 3 Sensor	On/Off	Off

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Rear ISO Valve Feedback	4WAL 3 Sensor	On/Off	Off
Rear Wheel Speed	4WAL 3 Sensor	km/h or mph	5 km/h/3 mph
RF Dump Valve Command	4WAL 3 Sensor	On/Off	Off
RF Dump Valve Feedback	4WAL 3 Sensor	On/Off	Off
RF ISO Valve Command	4WAL 3 Sensor	On/Off	Off
RF ISO Valve Feedback	4WAL 3 Sensor	On/Off	Off
Right Front Wheel Speed	4WAL 3 Sensor	km/h or mph	5 km/h/3 mph

SCAN TOOL DATA DEFINITIONS

The ABS scan tool data definitions contain a brief description of all ABS related parameters available on the scan tool. The parameters available on the scan tool are listed below in alphanumeric order.

4WD Status

The scan tool displays Two wheel drive/Four wheel drive. The scan tool displays Two wheel drive when the transfer case is shifted into two wheel drive.

ABS Lamp Command

The scan tool displays On/Off. The scan tool displays On when the ABS indicator is commanded ON.

ABS Pump Motor

The scan tool displays On/Off. The scan tool displays On when the ABS pump motor is commanded ON.

ABS Relay Command

The scan tool displays On/Off. The scan tool displays On when the system relay is commanded ON.

ABS Stop State

The scan tool displays On/Off. The scan tool displays On when the ABS is active.

Brake Switch Status

The scan tool displays On/Off. The scan tool displays On when the brake is applied.

Brake Warning Lamp Cmd

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The scan tool displays On/Off. The scan tool displays On when the red brake warning indicator is commanded ON.

Diff. Pressure/Fluid Level

The scan tool displays Ok/Low. The scan tool displays Ok when the brake fluid reservoir has an adequate fluid level.

DRP Active

The scan tool displays Yes/No. The scan tool displays Yes when the DRP is active.

Left Front Wheel Speed

The scan tool displays 5-257 km/h (3-160 mph). The scan tool displays 5 km/h (3 mph) when the vehicle is not moving or is moving at speeds less than or equal to 5 km/h (3 mph).

LF Dump Valve Command

The scan tool displays On/Off. The scan tool displays On when the left front dump valve solenoid is commanded ON.

LF Dump Valve Feedback

The scan tool displays On/Off. The scan tool displays On when the left front dump valve solenoid is energized.

LF ISO Valve Command

The scan tool displays On/Off. The scan tool displays On when the left front isolation valve solenoid is commanded ON.

LF ISO Valve Feedback

The scan tool displays On/Off. The scan tool displays On when the left front isolation valve solenoid is energized.

Rear Dump Valve Command

The scan tool displays On/Off. The scan tool displays On when the rear dump valve solenoid is commanded ON.

Rear Dump Valve Feedback

The scan tool displays On/Off. The scan tool displays On when the rear dump valve

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solenoid is energized.

Rear ISO Valve Command

The scan tool displays On/Off. The scan tool displays On when the rear isolation valve solenoid is commanded ON.

Rear ISO Valve Feedback

The scan tool displays On/Off. The scan tool displays On when the rear isolation valve solenoid is energized.

Rear Wheel Speed

The scan tool displays 5-257 km/h (3-160 mph). The scan tool displays 5 km/h (3 mph) when the vehicle is not moving or moving at speeds less than or equal to 5 km/h (3 mph).

RF Dump Valve Command

The scan tool displays On/Off. The scan tool displays On when the right front dump valve solenoid is commanded ON.

RF Dump Valve Feedback

The scan tool displays On/Off. The scan tool displays On when the right front dump valve solenoid is energized.

RF ISO Valve Command

The scan tool displays On/Off. The scan tool displays On when the right front isolation valve solenoid is commanded ON.

RF ISO Valve Feedback

The scan tool displays On/Off. The scan tool displays On when the right front isolation valve solenoid is energized.

Right Front Wheel Speed

The scan tool displays 5-257 km/h (3-160 mph). The scan tool displays 5 km/h (3 mph) when the vehicle is not moving or moving at speeds less than or equal to 5 km/h (3 mph).

DIAGNOSTIC TROUBLE CODE (DTC) LIST

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Diagnostic Trouble Code (DTC) List

DTC	DTC	Description	Module(s)
C0221	<u>DTC C0221</u>	Right Front Wheel Speed Sensor Circuit Open	EBCM
C0222	<u>DTC C0222</u>	Right Front Wheel Speed Signal Missing	EBCM
C0223	<u>DTC C0223</u>	Right Front Wheel Speed Signal Erratic	EBCM
C0225	<u>DTC C0225</u>	Left Front Wheel Speed Sensor Circuit Open	EBCM
C0226	<u>DTC C0226</u>	Left Front Wheel Speed Signal Missing	EBCM
C0227	<u>DTC C0227</u>	Left Front Wheel Speed Signal Erratic	EBCM
C0229	<u>DTC C0229</u>	Drop Out of Front Wheel Speed Signals	EBCM
C0235	<u>DTC C0235</u>	Rear Wheel Speed Signal Circuit Open	EBCM, PCM
C0236	<u>DTC C0236</u>	Rear Wheel Speed Signal Circuit Missing	EBCM, PCM
C0237	<u>DTC C0237</u>	Rear Wheel Speed Signal Erratic	EBCM, PCM
C0238	<u>DTC C0238</u>	Wheel Speed Mismatch	EBCM, PCM
C0241	<u>DTC C0241</u>	EBCM Control Valve Circuit	EBCM
C0245	<u>DTC C0245</u>	Wheel Speed Sensor Frequency Error	EBCM
C0254	<u>DTC C0254</u>	EBCM Control Valve Circuit	EBCM
C0265	<u>DTC C0265</u>	EBCM Relay Circuit	EBCM
C0266	<u>DTC C0266</u>	EBCM Relay Circuit	EBCM
C0267	<u>DTC C0267</u>	Pump Motor Circuit Open/Shorted	EBCM
C0268	<u>DTC C0268</u>	Pump Motor Circuit Open/Shorted	EBCM
C0269	<u>DTC C0269</u>	Excessive Dump/Isolation Time	EBCM
C0271	<u>DTC C0271</u>	EBCM Malfunction	EBCM
C0272	<u>DTC C0272</u>	EBCM Malfunction	EBCM
C0273	<u>DTC C0273</u>	EBCM Malfunction	EBCM
C0274	<u>DTC C0274</u>	Excessive Dump/Isolation Time	EBCM
C0281	<u>DTC C0281</u>	Brake Switch Circuit	EBCM
C0284	<u>DTC C0284</u>	EBCM Malfunction	EBCM

DTC C0221-C0227**Circuit Description**

As the wheel spins, the wheel speed sensor produces an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

Conditions for Running the DTC

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C0221 and C0225

The ignition is ON.

C0222, C0223, C0226 and C0227

The vehicle speed is greater than 32 km/h (20 mph) when the brake is applied or 19 km/h (12 mph) when the brake is released.

Conditions for Setting the DTC

C0221 and C0225

The EBCM detects an open or shorted wheel speed sensor or wheel speed sensor circuit for 500 milliseconds.

C0222 and C0226

The corresponding wheel speed sensor signal is less than 6 km/h (4 mph) for 5 seconds, or 120 seconds in order to set both DTCs.

C0223 and C0227

The EBCM detects an erratic signal from the corresponding wheel speed sensor for 105 milliseconds.

Action Taken When the DTC Sets

C0221, C0225

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.

C0222, C0223, C0226, and C0227

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS and may disable DRP.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.
- The red Brake warning indicator may turn ON.

Conditions for Clearing the DTC

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- Repair the condition responsible for setting the DTC.
- Use a scan tool in order to clear the DTC.
- After the DTC is cleared and the ignition is ON, the ABS indicator may remain ON until the EBCM completes a power-up self-test. This test concludes when the vehicle reaches a speed greater than 13 km/h (8 mph) and the wheel speeds are verified by the EBCM.

Diagnostic Aids

Operating the vehicle on extremely rough terrain can set DTC C0223, C0227 or C0229 even if the system is functioning normally.

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Intermittent Conditions and Poor Connections** , **Connector Repairs** , **Testing for Electrical Intermittents** and to **Wiring Repairs** in Wiring Systems.

If the customer's concern is that the ABS indicator is on only during humid conditions such as rain, snow or vehicle wash, thoroughly inspect the wheel speed sensor circuits for signs of water intrusion. Use the following procedure in order to help isolate the problem area:

1. Spray the suspected area with a 5 percent salt water solution.
2. Drive the vehicle at a speed greater than 19 km/h (12 mph) for at least 30 seconds.

Repair or replace the suspect harness if the DTC sets.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: Measure the resistance of the wheel speed sensor in order to determine if the sensor has a valid resistance value.

4: Ensures that the wheel speed sensor is generating a valid AC voltage output.

DTC C0221-C0227

Step	Action	Values	Yes	No
Schematic Reference: ABS Schematics Connector End View Reference: <u>ABS Connector End Views</u> IMPORTANT: If DTC C0229 is set, diagnose DTC C0229 before diagnosing any other wheel speed sensor DTCs.				
1	Did you perform the ABS Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>

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2	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle at a speed greater than the specified value. Does the DTC set?	19 km/h (12 mph)	Go to Step 3	Go to Diagnostic Aids
3	1. Turn OFF the ignition. 2. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> in General Information. 3. Disconnect the wheel speed sensor connector. 4. Use a DMM in order to measure the resistance across the wheel speed sensor. Does the resistance measure within the specified range?	700-10,000 ohm	Go to Step 4	Go to Step 8
4	1. Spin the wheel by hand as fast as possible. 2. Use a DMM in order to measure the AC voltage across the wheel speed sensor as the wheel spins. Does the AC voltage measure greater than the specified value?	100 mV	Go to Step 5	Go to Step 8
5	Inspect for poor connections at the harness connector of the wheel speed sensor. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and to <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	-	Go to Step 10	Go to Step 6
6	1. Disconnect the EBCM harness connector. 2. Test the wheel speed sensor circuits for the following: • An open • A short to ground • A short to voltage	-		

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	Shorted together Refer to Circuit Testing and to Wiring Repairs in Wiring Systems. Did you find and correct the condition?		Go to Step 10	Go to Step 7
7	Inspect for poor connections at the harness connector for the EBCM. Refer to Testing for Intermittent Conditions and Poor Connections and to Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 10	Go to Step 9
8	Replace the wheel speed sensor. Refer to Wheel Speed Sensor Replacement (4WD Pickup) or Wheel Speed Sensor Replacement (RWD Pickup) or Wheel Speed Sensor Replacement (RWD Utility) . Did you complete the replacement?	-	Go to Step 10	-
9	IMPORTANT: Use the scan tool in order to perform the Tire Size Calibration procedure. Replace the EBCM. Refer to Electronic Brake Control Module Replacement . Did you complete the replacement?	-	Go to Step 10	-
10	- Use the scan tool in order to clear the DTCs. - Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to Step 2	System OK

DTC C0229

Circuit Description

As the wheel spins, the wheel speed sensor produces an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

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Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 32 km/h (20 mph) when the brake is applied or 19 km/h (12 mph) when the brake is released.

Conditions for Setting the DTC

The EBCM detects an erratic signal from both front wheel speed sensors for 105 milliseconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS/DRP.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.
- The red brake warning indicator turns ON.

Conditions for Clearing the DTC

- Repair the condition responsible for setting the DTC.
- Use a scan tool in order to clear the DTC.
- After the DTC is cleared and the ignition is ON, the ABS indicator may remain ON until the EBCM completes a power-up self-test. This test concludes when the vehicle reaches a speed greater than 13 km/h (8 mph) and the wheel speeds are verified by the EBCM.

Diagnostic Aids

Operating the vehicle on extremely rough terrain can set DTC C0223, C0227 or C0229 even if the system is functioning normally.

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Intermittent Conditions and Poor Connections** , **Connector Repairs** , **Testing for Electrical Intermittents** and to **Wiring Repairs** in Wiring Systems.

If the customer's concern is that the ABS indicator is on only during humid conditions such as rain, snow or vehicle wash, thoroughly inspect the wheel speed sensor circuits for signs of water intrusion. Use the following procedure in order to help isolate the problem area:

1. Spray the suspected area with a 5 percent salt water solution.
2. Drive the vehicle at a speed greater than 19 km/h (12 mph) for at least 30 seconds.

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Repair or replace the suspect harness if the DTC sets.

DTC C0229

Step	Action	Yes	No
Schematic Reference: ABS Schematics			
Connector End View Reference: ABS Connector End Views			
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC set?	Go to Step 3	Go to Diagnostic Aids
3	Inspect for poor connections at the harness connector of the EBCM. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and to <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 5	Go to Step 4
4	IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure. Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> .Did you complete the replacement?	Go to Step 5	-
5	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 3	System OK

DTC C0235-C0237 OR P0609**Circuit Description**

The PCM converts the data from the vehicle speed sensor to a 128k pulses/mile signal. The

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EBCM uses the vehicle speed signal from the PCM in order to calculate the rear wheel speed.

Conditions for Running the DTC

C0235

The ignition is ON.

C0236 and C0237

- The ignition is ON.
- The vehicle speed is greater than 32 km/h (20 mph) when the brake is applied or 19 km/h (12 mph) when the brake is released.

P1504

- The ignition is ON.
- The vehicle is not moving.

Conditions for Setting the DTC

C0235

The EBCM detects low voltage on the vehicle speed signal circuit for 500 milliseconds.

C0236

The rear wheel speed signal is less than 6 km/h (4 mph) for 5 seconds, or 120 seconds in order to set multiple missing sensor signal DTCs.

C0237

The EBCM detects an erratic rear wheel speed signal for 105 milliseconds.

P1504

The PCM detects low voltage on the vehicle speed signal circuit for 45 seconds.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS/DRP.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.
- The red brake warning indicator turns ON.

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Conditions for Clearing the DTC

- Repair the condition responsible for setting the DTC.
- Use a scan tool in order to clear the DTC.
- After the DTC is cleared and the ignition is ON, the ABS indicator may remain ON until the EBCM completes a power-up self-test. This test concludes when the vehicle reaches a speed greater than 13 km/h (8 mph) and the wheel speeds are verified by the EBCM.

Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Electrical Intermittents** , **Testing for Intermittent Conditions and Poor Connections** , **Wiring Repairs** and **Connector Repairs** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

3: This step tests for a voltage signal from the PCM.

4: This step tests for a missing or erratic vehicle speed signal from the PCM. An assistant may be required to perform this test.

DTC C0235-C0237 or P0609

Step	Action	Values	Yes	No
Schematic Reference: <u>ABS Schematics</u>				
1	Did you perform the ABS Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC set?	-	Go to Step 3	Go to Diagnostic Aids
	1. Turn OFF the ignition. 2. Disconnect from the EBCM, the harness connector containing the vehicle speed signal circuit. 3. Turn ON the ignition.			

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3	4. Use a DMM in order to measure the DC voltage between the vehicle speed signal circuit and a good ground. Does the voltage measure greater than the specified value?	10 volts	Go to Step 4	Go to Step 7
4	1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> in General Information. 2. Place the transmission in neutral (N). 3. Set up the DMM in order to measure the DC voltage between the vehicle speed signal circuit and a good ground. 4. Spin the rear wheels as fast as possible by hand for at least 30 seconds and while ensuring the driveshaft is rotating, observe the DMM. Does the voltage measure within the specified range the entire time the driveshaft is rotating?	5-7 volts	Go to Step 5	Go to Step 7
5	Inspect for poor connections at the harness connector of the EBCM. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	-	Go to Step 10	Go to Step 6
6	Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> . IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure.	-	Go to Step	-

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	Did you complete the replacement?		10	
7	Test the vehicle speed signal circuit for an open, a short to ground or a short to voltage. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 10	Go to Step 8
8	Inspect for poor connections at the harness connector of the PCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 10	Go to Step 9
9	IMPORTANT: Perform the setup procedure for the PCM. Replace the PCM. Refer to Powertrain Control Module (PCM) Replacement in Engine Controls - 4.3 L. Did you complete the replacement?	-	Go to Step 10	-
10	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to Step 3	System OK

DTC C0238

Circuit Description

As the front wheels spin, the wheel speed sensors (WSSs) produce an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed. The powertrain control module (PCM) converts the data from the vehicle speed sensor (VSS) to a 128k pulses/mile signal. The EBCM uses the vehicle speed signal from the PCM in order to calculate the rear wheel speed.

Conditions for Running the DTC

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The ignition is ON and the vehicle speed is between 24 km/h (15 mph) and 80 km/h (50 mph).

Conditions for Setting the DTC

The EBCM detects that one wheel speed input is 10 percent greater than or 10 percent less than the other wheel speed inputs within 3.2 km (2 mi) of driving.

Action Taken When the DTC Sets

If equipped, the following actions occur:

- The EBCM disables the ABS/TCS/DRP.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.
- The red brake warning indicator turns ON.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Installing one tire of significantly different size on the vehicle causes DTC C0238 to set. Operating the vehicle with a tire that has very low air pressure may also set this DTC. Inspect the vehicle for an incorrect or damaged wheel speed sensor or vehicle speed sensor if the tires and the EBCM and PCM calibrations are OK.

Test Description

The number below refers to the step number on the diagnostic table:

- 4:** If the front tires are not the same size as the rear tires, the EBCM calibration must match the FRONT tire size and the PCM calibration must match the REAR tire size.

DTC C0238

Step	Action	Yes	No
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	Inspect both of the front tires on the vehicle to ensure that both tires are of equal size. Are both of the front tires of equal size?	Go to Step 3	Go to Diagnostic Aids

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3	Inspect both of the rear tires on the vehicle to ensure that both tires are of equal size. Are both of the rear tires of equal size?	Go to Step 4	Go to Diagnostic Aids
4	Verify the EBCM and the PCM both have the correct tire size calibration. Use the scan tool in order to view the EBCM tire size calibration or perform the Tire Size Calibration procedure and refer to Service Programming System (SPS) in Programming. Did you find and correct the condition?	Go to Step 5	Go to Diagnostic Aids
5	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle for 3.2 km (2 mi) within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK

DTC C0241-C0254

Circuit Description

The ABS relay supplies battery voltage to 6 valve solenoids. The electronic brake control module (EBCM) microprocessor applies the grounds needed to activate each solenoid. The low side of each solenoid coil has a feedback circuit to the EBCM microprocessor. When a solenoid is commanded OFF, the feedback voltage is high. When a solenoid is commanded ON, the feedback voltage is low.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 6 km/h (4 mph).

Conditions for Setting the DTC

The EBCM detects an internal malfunction.

Action Taken When the DTC Sets

C0241, C0242, C0245, C0246, C0251, C0252, C0253, C0254

If equipped, the following actions occur:

- The EBCM disables the DRP/ABS.

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- The ABS indicator turns ON.
- The red brake warning indicator turns ON.

C0243, C0244, C0247, C0248

If equipped, the following actions occur:

- The EBCM disables the ABS.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

An intermittent open/shorted solenoid DTC can be set by several different internal EBCM problems. Replace the EBCM if an open/shorted solenoid DTC continues to set intermittently.

DTC C0241-C0254

Step	Action	Yes	No
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC set?	Go to Step 3	Go to Diagnostic Aids
3	IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure and the Trim Level Calibration procedure, if applicable. Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> .Did you complete the replacement?	Go to Step 4	-
	1. Use the scan tool in order to clear the DTCs.		

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4	2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text.		
	Does the DTC reset?	Go to Step 3	System OK

DTC C0265 OR C0266

Circuit Description

The ABS relay supplies battery voltage to 6 valve solenoids. The electronic brake control module (EBCM) microprocessor applies the grounds needed to activate each solenoid. The low side of each solenoid coil has a feedback circuit to the EBCM microprocessor. When a solenoid is commanded OFF, the feedback voltage is high. When a solenoid is commanded ON, the feedback voltage is low.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 6 km/h (4 mph).

Conditions for Setting the DTC

The EBCM detects an internal malfunction.

Action Taken When the DTC Sets

C0265

If equipped, the following actions occur:

- The EBCM disables the DRP/ABS.
- The ABS indicator turns ON.
- The brake warning indicator turns ON.

C0266

If equipped, the following actions occur:

- The EBCM disables the ABS.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

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Diagnostic Aids

IMPORTANT: Whenever the EBCM is replaced for DTC C0265 or C0266, the ABS pump motor and motor circuitry must be tested for the proper resistance. Refer to steps 7 and 8 in the diagnostic table below for testing procedures and resistance values.

C0265

Thoroughly inspect connections and circuitry that may cause an intermittent malfunction. Refer to Testing for Intermittent Conditions and Poor Connections , Testing for Electrical Intermittents , Connector Repairs and to Wiring Repairs in Wiring Systems.

C0266

Replace the EBCM if DTC C0266 continues to set intermittently.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step tests if the battery positive voltage circuit can supply adequate power to the system relay.

7: A shorted ABS pump motor or shorted motor circuitry may damage the contacts within the system relay. Follow this step to prevent damage to a replacement EBCM.

DTC C0265 or C0266

Step	Action	Values	Yes	No
Schematic Reference: <u>ABS Schematics</u>				
Connector End View Reference: <u>ABS Connector End Views</u>				
1	Did you perform the ABS Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Use a scan tool in order to clear the DTCs. 2. Use the scan tool in order to perform an ABS Function Test. Does DTC C0266 set?	-	Go to Step 7	Go to Step 3
3	Does DTC C0265 set?	-	Go to Step 4	Go to Diagnostic Aids
	1. Turn OFF the ignition.			

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4	2. Disconnect from the EBCM, the harness connector containing the battery positive voltage circuit. 3. Connect a test lamp between the battery positive voltage circuit and a good ground. Does the test lamp illuminate?	-	Go to Step 6	Go to Step 5
5	Repair the open in the battery positive voltage circuit. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you complete the repair?	-	Go to Step 11	-
6	Inspect for poor connections at the harness connector of the EBCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?	-	Go to Step 11	Go to Step 7
7	IMPORTANT: It may be necessary to separate the EBCM from the BPMV to gain access to the pump motor pigtail connector. If so, refer to Electronic Brake Control Module Replacement. 1. Disconnect from the EBCM, the ABS pump motor pigtail connector. 2. Use a DMM in order to measure the resistance across the ABS pump motor. Does the resistance measure within the specified range?	0.3-1.0 ohm	Go to Step 8	Go to Step 10
8	Use a DMM in order to measure the resistance between the high side of the pump motor and a good ground. Does the resistance measure less than the specified value?	0L	Go to Step 10	Go to Step 9
	IMPORTANT: Use the scan tool in order to perform the Tire Size Calibration procedure and the			

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	Trim Level Calibration procedure, if applicable.			
9	Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> .Did you complete the replacement?	-	Go to Step 11	-
10	IMPORTANT: Use the scan tool in order to perform the Tire Size Calibration procedure and the Trim Level Calibration procedure, if applicable. Replace the EBCM and the BPMV. Refer to <u>Electronic Brake Control Module Replacement</u> and <u>Brake Pressure Modulator Valve (BPMV) Replacement</u> .Did you complete the replacements?	-	Go to Step 11	-
11	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to Step 2	System OK

DTC C0267 OR C0268

Circuit Description

The EBCM applies the ground needed for pump motor activation. The low side of the pump motor has a feedback circuit to the EBCM. When the pump motor is commanded OFF and at rest, feedback voltage is high. When the pump motor is winding down after being commanded ON and then OFF, feedback voltage is low. The EBCM monitors this feedback voltage in order to determine if the motor is functioning properly.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 6 km/h (4 mph).

Conditions for Setting the DTC

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The EBCM detects any of the following conditions:

- An open or shorted pump motor
- An open or shorted pump motor driver circuit
- A seized pump motor

Action Taken When the DTC Sets

- The EBCM disables the ABS.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Electrical Intermittents** , **Testing for Intermittent Conditions and Poor Connections** , **Wiring Repairs** and **Connector Repairs** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: It is imperative that the vehicle be driven to attempt to reset the DTC. Using the scan tool to perform a function test may not produce the same result, and therefore may cause misdiagnosis of the vehicle.

7: This step tests if the EBCM is capable of activating the ABS pump motor.

8: A shorted ABS pump motor may damage the EBCM. It is imperative that the steps in the table be followed in order to prevent damage to a replacement EBCM.

DTC C0267 or C0268

Step	Action	Values	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u>				
1	Did you perform the ABS Diagnostic System Check?	-	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle within the			

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2	Conditions for Running the DTC as specified in the supporting text. Does DTC C0267 set?	-	Go to Step 6	Go to Step 3
3	Does DTC C0268 set?	-	Go to Step 4	Go to Diagnostic Aids
4	1. Turn OFF the ignition. 2. Disconnect from the EBCM, the 2-way harness connector which contains the battery positive voltage circuit and the ground circuit. CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices. 3. Disconnect the negative battery cable. 4. Disconnect the positive battery cable. 5. Place one lead of a DMM on the positive battery cable where the cable normally connects to the battery. 6. Place the other lead on the battery positive voltage circuit terminal within the 2-way EBCM harness connector. 7. Measure the total resistance between the positive battery cable and the EBCM. Does the resistance measure within the specified range?	0.0-0.2 ohm	Go to Step 5	Go to Step 10
5	Use a DMM to measure the resistance of the ground circuit. Does the resistance measure within the specified range?	0.0-0.2 ohm	Go to Step 7	Go to Step 11
	IMPORTANT: On some applications, it may be necessary to separate the EBCM from the BPMV in			

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6	order to perform this test. Also, DTC C0268 may set when this test is performed. 1. Turn OFF the ignition. 2. Disconnect from the EBCM, the ABS pump motor pigtail connector. For systems which have no pump motor pigtail, it is necessary to separate the EBCM from the BPMV in order to gain access to the pump motor connector of the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u>. 3. Use a connector adapter test kit in order to connect a test lamp between the ABS pump motor power and ground circuits at the pump motor connector of the EBCM. 4. Turn ON the ignition. 5. Use the scan tool in order to clear the DTCs. 6. Use the scan tool in order to perform an ABS Function Test. Does DTC C0267 set?	-	Go to Step 12	Go to Step 9
	IMPORTANT: On some applications, it may be necessary to separate the EBCM from the BPMV in order to perform this test. Also, DTC C0268 may set when this test is performed. 1. Reconnect both battery cables. 2. Disconnect from the EBCM, the ABS pump motor pigtail connector. For systems which have no pump motor pigtail, it is necessary to separate the EBCM from the BPMV in order to gain access to the pump motor connector of the EBCM. Refer to <u>Electronic Brake Control</u>			

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7	<u>Module Replacement</u> . 3. Use a connector adapter test kit in order to connect a test lamp between the ABS pump motor power and ground circuits at the pump motor connector of the EBCM. 4. Turn ON the ignition. 5. Use the scan tool in order to clear the DTCs. 6. Use the scan tool in order to perform an ABS Function Test. Does the test lamp illuminate and then turn OFF when the Function Test is performed?	-	Go to Step 13	Go to Step 8
8	Use a DMM in order to measure the resistance across the ABS pump motor. Does the resistance measure within the specified range?	0.3-1.0 ohm	Go to Step 12	Go to Step 14
9	Inspect for poor connections at the pump motor pigtail connector. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and to <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	-	Go to Step 15	Go to Step 13
10	Repair the high resistance in the underhood electrical center or the battery positive voltage circuit. Refer to <u>Wiring Repairs</u> in Wiring Systems. Did you complete the repair?	-	Go to Step 15	-
11	Repair the high resistance in the ground circuit. Refer to <u>Wiring Repairs</u> in Wiring Systems. Did you complete the repair?	-	Go to Step 15	-
12	IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure and the Trim Level Calibration procedure, if applicable. Replace the EBCM. Refer to	-		-

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	<u>Electronic Brake Control Module Replacement</u> .Did you complete the replacement?		Go to Step 15	
13	Replace the BPMV. Refer to <u>Brake Pressure Modulator Valve (BPMV) Replacement</u> . Did you complete the replacement?	-	Go to Step 15	-
14	IMPORTANT: Following EBCM replacement, use the scan tool perform the Tire Size Calibration procedure and the Trim Level Calibration procedure, if applicable. Replace the EBCM and the BPMV. Refer to <u>Electronic Brake Control Module Replacement</u> and to <u>Brake Pressure Modulator Valve (BPMV) Replacement</u> .Did you complete the replacements?	-	Go to Step 15	-
15	1. Use a scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	-	Go to Step 3	System OK

DTC C0269 OR C0274**Circuit Description**

The system relay is energized when the ignition is ON. The system relay supplies voltage to the valve solenoids and the pump motor. This voltage is referred to as the system voltage. The electronic brake control module (EBCM) microprocessor activates the valve solenoids by grounding the control circuit.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle is experiencing an ABS event.

Conditions for Setting the DTC**C0269**

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The EBCM commands a dump solenoid ON for 9 consecutive seconds.

C0274

The EBCM commands an isolation solenoid ON for 255 consecutive seconds.

Action Taken When the DTC Sets

If equipped, the following actions may occur:

- The EBCM disables the ABS/TCS/DRP.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.
- The red brake warning indicator turns ON.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

The most likely cause of DTC C0269 or DTC C0274 is a mechanical failure that causes a wheel to lock and remain locked. The DTCs may also set, conceivably, when the ABS is activated on surfaces that are nearly impossible to get traction on. If the DTC sets within these conditions, diagnosis of the ABS system is not necessary.

Test Description

The number below refers to the step number on the diagnostic table:

2: Performing solenoid tests determines if there is a mechanical malfunction inside the BPMV. Perform dump valve solenoid tests for DTC C0269 or isolation valve solenoid tests for DTC C0274.

DTC C0269 or C0274

Step	Action	Yes	No
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
	1. Use a scan tool in order to clear the DTCs. 2. Use the scan tool in order to perform the necessary Solenoid Tests. Refer to		

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2	<u>Scan Tool Output Controls</u> .		
	Do the Solenoid Tests show the system to be functioning normally?	Go to Diagnostic Aids	Go to Step 3
	Replace the BPMV. Refer to <u>Brake Pressure Modulator Valve (BPMV) Replacement</u> . Did you complete the replacement?	Go to Step 4	-
4	Use the scan tool in order to perform the necessary Solenoid Tests. Do the Solenoid Tests show the system to be functioning normally?	System OK	Go to Step 3

DTC C0271-C0273, C0284

Circuit Description

This DTC identifies a malfunction within the electronic brake control module (EBCM).

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

The EBCM detects an internal malfunction.

Action Taken When the DTC Sets

If equipped, the following actions may occur:

- The EBCM disables the ABS/TCS/DRP.
- The ABS indicator turns ON.
- The TRACTION OFF indicator turns ON.
- The red brake warning indicator turns ON.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Replace the EBCM if DTC C0273 or DTC C0284 continues to set intermittently.

DTC C0271-C0273, C0284

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Step	Action	Yes	No
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to Diagnostic System Check - ABS
2	Is DTC C0271 or DTC C0272 set in the EBCM memory?	Go to Step 4	Go to Step 3
3	1. Use a scan tool in order to clear the DTCs. 2. Turn OFF the ignition for 5 seconds. 3. Turn ON the ignition. Does the DTC set?	Go to Step 4	Go to Diagnostic Aids
4	IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure and the Trim Level Calibration procedure, if applicable. Replace the EBCM. Refer to Electronic Brake Control Module Replacement .Did you complete the replacement?	Go to Step 5	-
5	Use the scan tool in order to clear the DTCs. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK

DTC C0281

Circuit Description

The stop lamp switch signal informs the electronic brake control module (EBCM) when the brake pedal is pressed.

Conditions for Running the DTC

Either of the following conditions will cause the DTC to run:

- The ignition is ON and the vehicle achieves at least 56 km/h (35 mph) before coming to a stop.
- The ignition is ON and the vehicle experiences an anti-lock brake system (ABS) event lasting at least 1 second.

Conditions for Setting the DTC

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The EBCM detects an open or shorted brake switch or brake switch circuit.

Action Taken When the DTC Sets

This information-only DTC is stored in EBCM memory until it is cleared by using the specified procedure.

Conditions for Clearing the DTC

The conditions for setting the DTC are no longer present and you use the scan tool Clear DTCs function.

Diagnostic Aids

Thoroughly inspect connections or circuitry that may cause an intermittent malfunction. Refer to **Testing for Electrical Intermittents** , **Testing for Intermittent Conditions and Poor Connections** , **Wiring Repairs** and **Connector Repairs** in Wiring Systems.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: This step tests for a shorted stop lamp switch.

5: This step tests for an open stop lamp switch.

DTC C0281

Step	Action	Yes	No
Schematic Reference: <u>ABS Schematics</u> Connector End View Reference: <u>ABS Connector End Views</u> or <u>Lighting Systems Connector End Views</u> in Lighting Systems			
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Install a scan tool. 2. Select the ABS Data Display function. 3. Observe the Brake Switch Status on the scan tool. Does the scan tool display Off?	Go to Step 3	Go to Step 5
3	1. Apply the brake. 2. Observe the Brake Switch Status on the scan tool.	Go to	

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	Does the scan tool display On?	Diagnostic Aids	Go to Step 4
4	1. Turn OFF the ignition. 2. Disconnect the stop lamp switch. Refer to Stop Lamp Switch Replacement in Lighting Systems. 3. Turn ON the ignition. 4. Observe the Brake Switch Status on the scan tool.		
	Does the scan tool display On?	Go to Step 9	Go to Step 7
5	1. Turn OFF the ignition. 2. Disconnect the stop lamp switch. Refer to Stop Lamp Switch Replacement in Lighting Systems. 3. Connect a fused jumper wire between the ignition 3 voltage circuit and the TCC brake switch signal circuit at the stop lamp switch harness connector. Refer to Using Fused Jumper Wires in Wiring Systems. 4. Turn ON the ignition. 5. Observe the Brake Switch Status on the scan tool.		
	Does the scan tool display Off?	Go to Step 9	Go to Step 6
6	Test the ignition 3 voltage circuit and the TCC brake switch signal circuit for an open or a short to ground. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?		
		Go to Step 12	Go to Step 8
7	Test the TCC brake switch signal circuit for a short to voltage. Refer to Circuit Testing and Wiring Repairs in Wiring Systems. Did you find and correct the condition?		
		Go to Step 12	Go to Step 8
8	Inspect for poor connections at the harness connector of the EBCM. Refer to Testing for Intermittent Conditions and Poor Connections and Connector Repairs in Wiring Systems. Did you find and correct the condition?		
		Go to Step 12	Go to Step 10

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9	Inspect for poor connections at the harness connector of the stop lamp switch. Refer to <u>Testing for Intermittent Conditions and Poor Connections</u> and <u>Connector Repairs</u> in Wiring Systems. Did you find and correct the condition?	Go to Step 12	Go to Step 11
10	IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure. Replace the EBCM. Refer to <u>Electronic Brake Control Module Replacement</u> .Did you complete the replacement?	Go to Step 12	-
11	Replace the stop lamp switch. Refer to <u>Stop Lamp Switch Replacement</u> in Lighting Systems. Did you complete the replacement?	Go to Step 12	-
12	1. Use the scan tool in order to clear the DTCs. 2. Operate the vehicle within the Conditions for Running the DTC as specified in the supporting text. Does the DTC reset?	Go to Step 2	System OK

SYMPTOMS - ANTI-LOCK BRAKE SYSTEM

IMPORTANT: The following steps must be completed before using the symptom tables:

1. Perform the ABS Diagnostic System Check before using the symptom tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **ABS Description and Operation** .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the ABS. Refer to

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Checking Aftermarket Accessories in Wiring Systems.

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer **Testing for Intermittent Conditions and Poor Connections** in Wiring Systems.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **ABS Indicator Always On**
- **ABS Indicator Inoperative**

ABS INDICATOR ALWAYS ON

Circuit Description

The instrument panel cluster (IPC) illuminates the ABS indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends class 2 serial data messages to the IPC in order to command the indicator ON or OFF.

Diagnostic Aids

The malfunction must be present during diagnosis in order to prevent unnecessary parts replacement. Always begin diagnosis with **Diagnostic System Check - ABS**.

Test Description

The number below refers to the step number on the diagnostic table.

3: This step tests if the IPC is able to turn OFF the ABS indicator.

ABS Indicator Always On

Step	Action	Yes	No
IMPORTANT: After a wheel speed sensor DTC is cleared and the ignition is ON, the ABS indicator may remain ON until the EBCM completes a power-up self test. This test concludes when the vehicle reaches a speed greater than 13 km/h (8 mph) and the wheel speeds are verified by the EBCM.			
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>

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2	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate for 2 seconds and then turn OFF?	Go to Diagnostic Aids	Go to Step 3
3	1. Install a scan tool. 2. Select the Instrument Panel Cluster Special Functions menu on the scan tool. 3. Command the ABS Lamp Off. Does the ABS indicator turn OFF?	Go to Step 5	Go to Step 4
4	Replace the instrument panel cluster. Refer to Instrument Panel Cluster (IPC) Replacement in Instrument Panel, Gages, and Console. Did you complete the replacement?	Go to Step 6	-
5	IMPORTANT: Following EBCM replacement, use the scan tool to perform the Tire Size Calibration procedure. Replace the EBCM. Refer to Electronic Brake Control Module Replacement .Did you complete the replacement?	Go to Step 6	-
6	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate for 2 seconds and then turn OFF?	System OK	Go to Step 3

ABS INDICATOR INOPERATIVE**Circuit Description**

The instrument panel cluster (IPC) illuminates the ABS indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends class 2 serial data messages to the IPC in order to command the indicator ON or OFF.

Diagnostic Aids

Replace the Instrument Panel Cluster if the ABS indicator intermittently fails to operate

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during the bulb check.

Test Description

The number below refers to the step number on the diagnostic table.

2: This step tests if the IPC is able to illuminate the ABS indicator during the bulb check.

ABS Indicator Inoperative

Step	Action	Yes	No
1	Did you perform the ABS Diagnostic System Check?	Go to Step 2	Go to <u>Diagnostic System Check - ABS</u>
2	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate?	Go to Diagnostic Aids	Go to Step 3
3	Replace the instrument panel cluster. Refer to <u>Instrument Panel Cluster (IPC) Replacement</u> in Instrument Panel, Gages, and Console. Did you complete the replacement?	Go to Step 4	-
4	1. Turn OFF the ignition for 5 seconds. 2. Turn ON the ignition while observing the ABS indicator. Does the ABS indicator illuminate?	System OK	Go to Step 3

REPAIR INSTRUCTIONS

ABS AUTOMATED BLEED PROCEDURE

CAUTION: Refer to **Brake Fluid Effects on Paint and Electrical Components Notice** in Cautions and Notices.

CAUTION: Refer to **Brake Dust Caution** in Cautions and Notices.

IMPORTANT:

- **Use the two-person bleed procedure under the following conditions:**
 - **Installing a new Electro-Hydraulic Control Unit (EHCU) or new Brake Pressure Modulator Valve (BPMV).**
 - **Air is trapped in the valve body.**
- **Do not drive the vehicle until the brake pedal feels firm.**
- **Do not reuse brake fluid that is used during bleeding.**
- **Use the vacuum, the pressure and the gravity bleeding procedures only for base brake bleeding.**

1. Raise the vehicle in order to access the system bleed screws.
2. Bleed the system at the right rear wheel first.
3. Install a clear hose on the bleed screw.
4. Immerse the opposite end of the hose into a container partially filled with clean DOT 3 brake fluid.
5. Open the bleed screw 1/2 to 1 full turn.
6. Slowly depress the brake pedal. While the pedal is depressed to its full extent, tighten the bleed screw.
7. Release the brake pedal and wait 10-15 seconds for the master cylinder pistons to return to the home position.
8. Repeat the previous steps for the remaining wheels. The brake fluid which is present at each bleed screw should be clean and free of air.
9. This procedure may use more than a pint of fluid per wheel. Check the master cylinder fluid level every four to six strokes of the brake pedal in order to avoid running the system dry.
10. Press the brake pedal firmly and run the Scan Tool Automated Bleed Procedure. Release the brake pedal between each test.
11. Bleed all four wheels again using Steps 3-9. This will remove the remaining air from the brake system.
12. Evaluate the feel of the brake pedal before attempting to drive the vehicle.
13. Bleed the system as many times as necessary in order to obtain the appropriate feel of the pedal.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

CAUTION: Refer to Brake Fluid Irritant Caution in Cautions and

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Notices.

NOTE: Refer to Brake Fluid Effects on Paint and Electrical Components Notice in Cautions and Notices.

IMPORTANT: After installation, calibrate the new EBCM to the tire size that is appropriate to the vehicle.

IMPORTANT: Thoroughly wash all contaminants from around the EHCU. The area around the EHCU must be free from loose dirt to prevent contamination of disassembled ABS components.

Removal Procedure

1. Disconnect the electrical connectors from the EBCM (2).

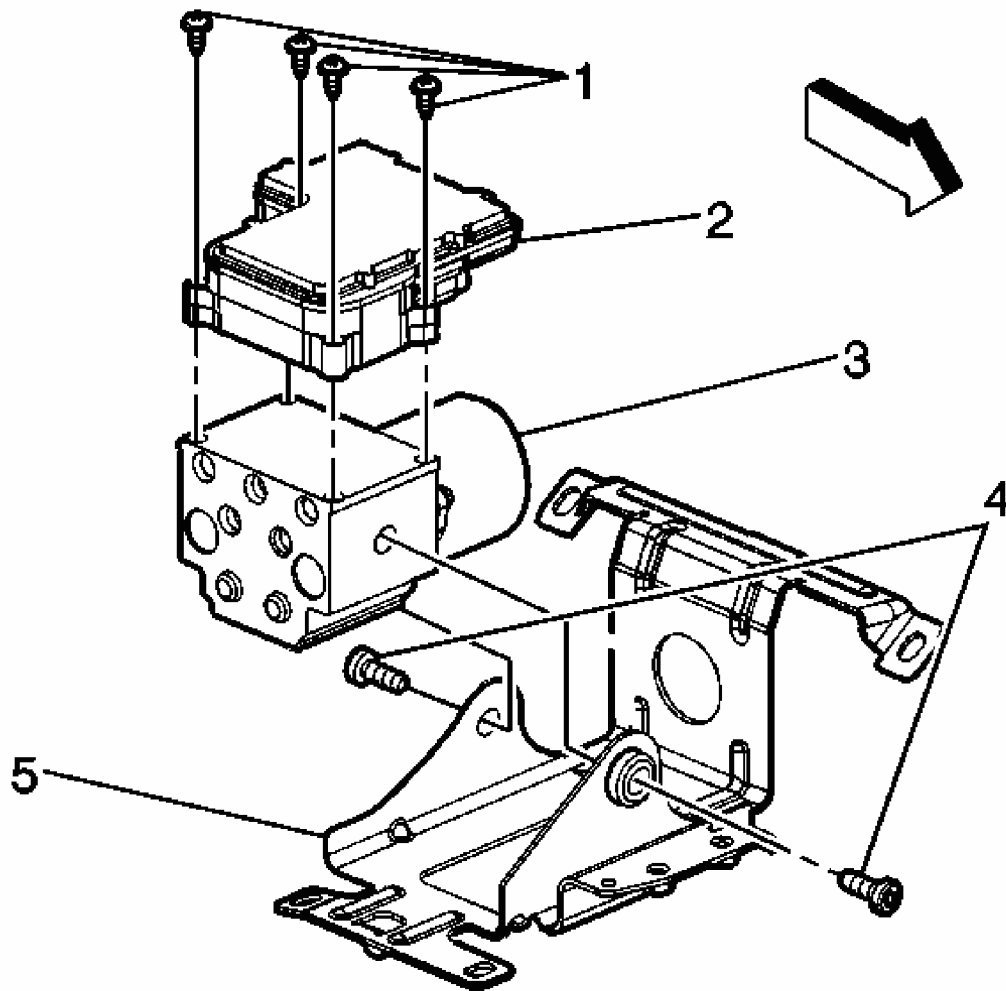


Fig. 6: Locating Electronic Brake Control Module Components
Courtesy of GENERAL MOTORS CORP.

2. Remove the four T 25-TORX(R) mounting screws (1) that fasten the EBCM (2) to the BPMV (3).
3. Remove the EBCM (2) from the BPMV (3). Removal may require a light amount of force.

IMPORTANT: Do not use a tool to pry the EBCM or the BPMV.

4. Clean the BPMV (3) to EBCM (2) mounting surfaces with a clean cloth.

IMPORTANT: Do not reuse the old mounting screws. Always install new mounting screws with the new EBCM.

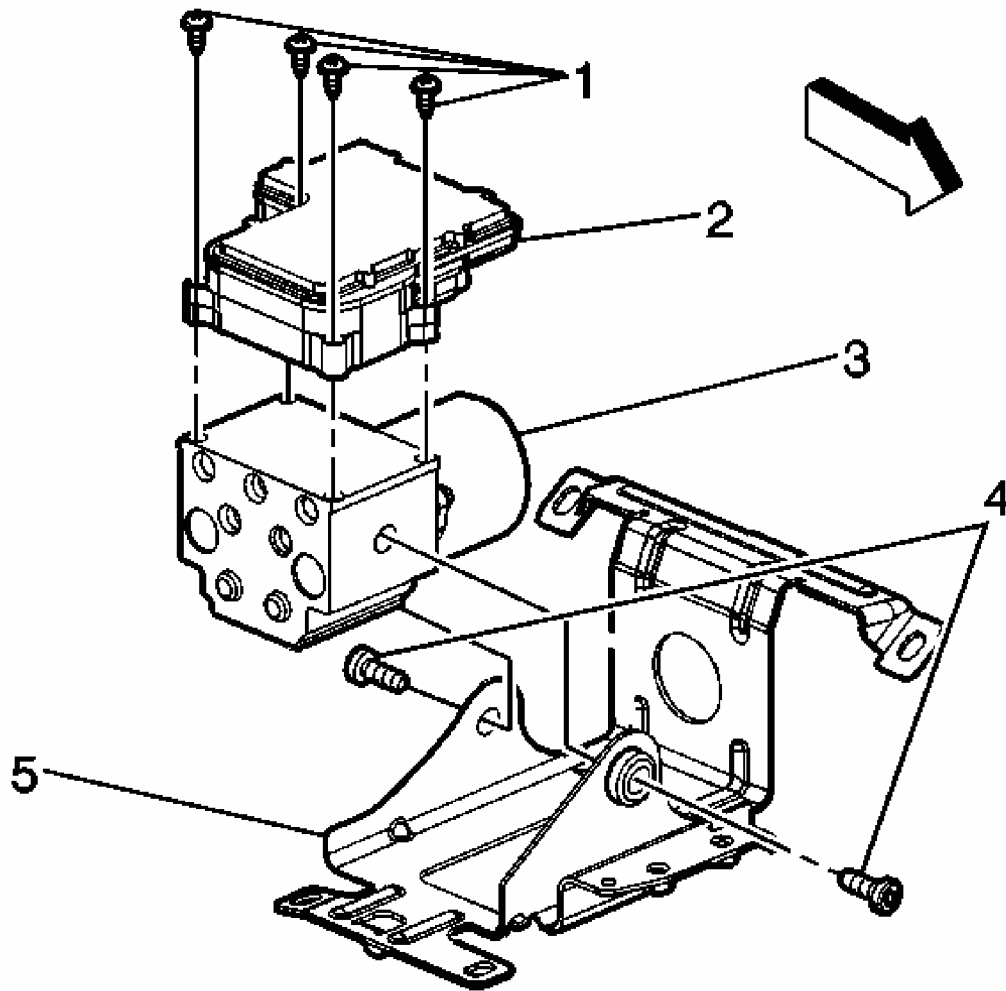


Fig. 7: Locating Electronic Brake Control Module Components
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not use RTV or any other type of sealant on the EBCM gasket or mating surfaces.

1. Install EBCM (2) on to the BPMV (3).

NOTE: Refer to Fastener Notice in Cautions and Notices.

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2. Install the four new T-25 TORX(R) screws (1) in the EBCM (2).

Tighten: Tighten the four T-25 TORX(R) screws to 5 N.m (39 lb in) in an X-pattern.

3. Connect the electrical connectors to the EBCM (2).
4. Revise the tire calibration using the Scan Tool Tire Size Calibration function.

BRAKE PRESSURE MODULATOR VALVE (BPMV) REPLACEMENT

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

CAUTION: Refer to Brake Fluid Irritant Caution in Cautions and Notices.

NOTE: Refer to Brake Fluid Effects on Paint and Electrical Components Notice in Cautions and Notices.

IMPORTANT: Thoroughly wash all contaminants from around the EHCU. The area around the EHCU must be free from loose dirt to prevent contamination of disassembled ABS components.

Removal Procedure

1. Disconnect the two electrical harness connectors from the EBCM (2).

IMPORTANT: Make sure that brake lines are tagged and kept in order for proper reassembly.

2. Disconnect the 5 brake lines from the BPMV (3).

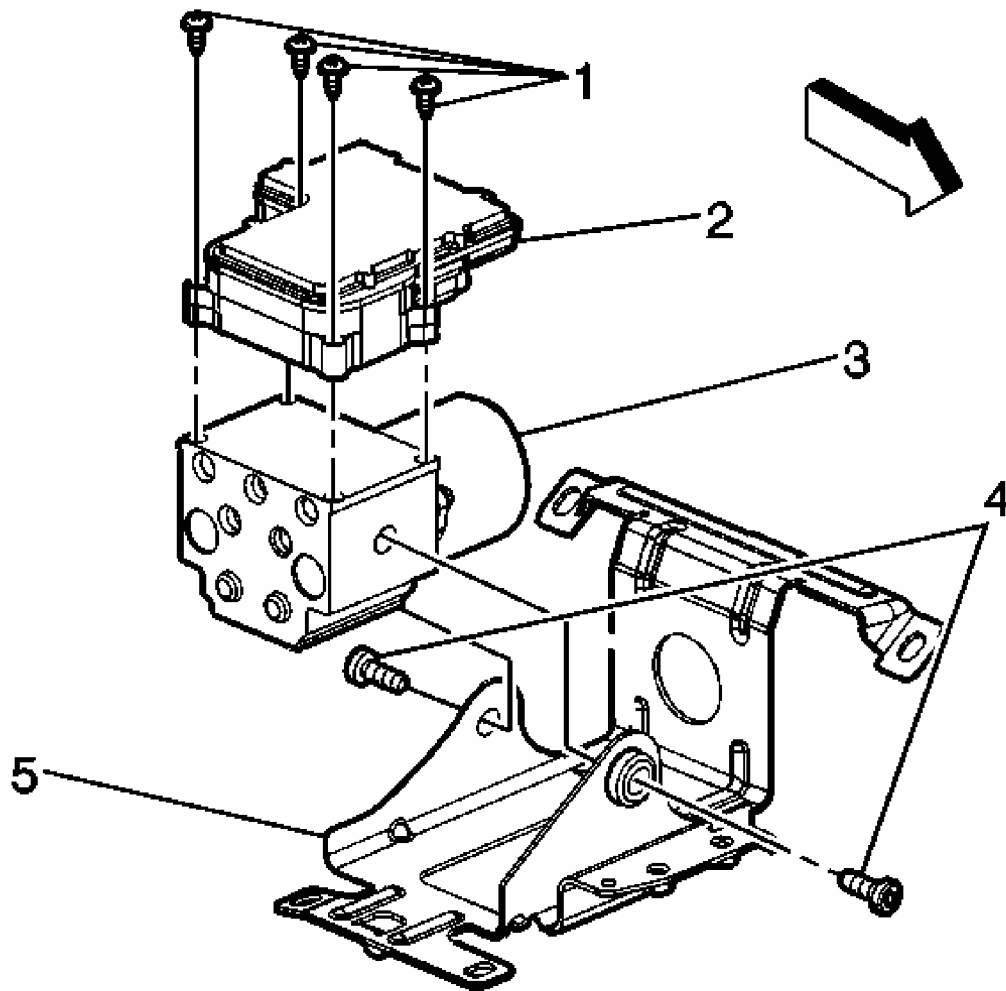


Fig. 8: Locating Electronic Brake Control Module Components
Courtesy of GENERAL MOTORS CORP.

3. Remove 2 bolts (4) securing the BPMV mounting bracket (5) to the BPMV (3).
4. Disconnect the 2 way ABS pump motor connector.
5. Remove the four T-25 TORX(R) screws (1) from the EBCM (2).

IMPORTANT: Do not use a tool to pry the EBCM or the BPMV. Excessive force will damage the EBCM.

IMPORTANT: Do not reuse the EBCM mounting bolts. Always install new bolts.

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6. Remove the EBCM (2) from the BPMV (3). Removal may require a light amount of force.
7. Clean the EBCM (2) to BPMV (3) mounting surfaces with a clean cloth.

Installation Procedure

IMPORTANT: Do not use RTV or any other type of sealant on the EBCM gasket or mating surfaces.

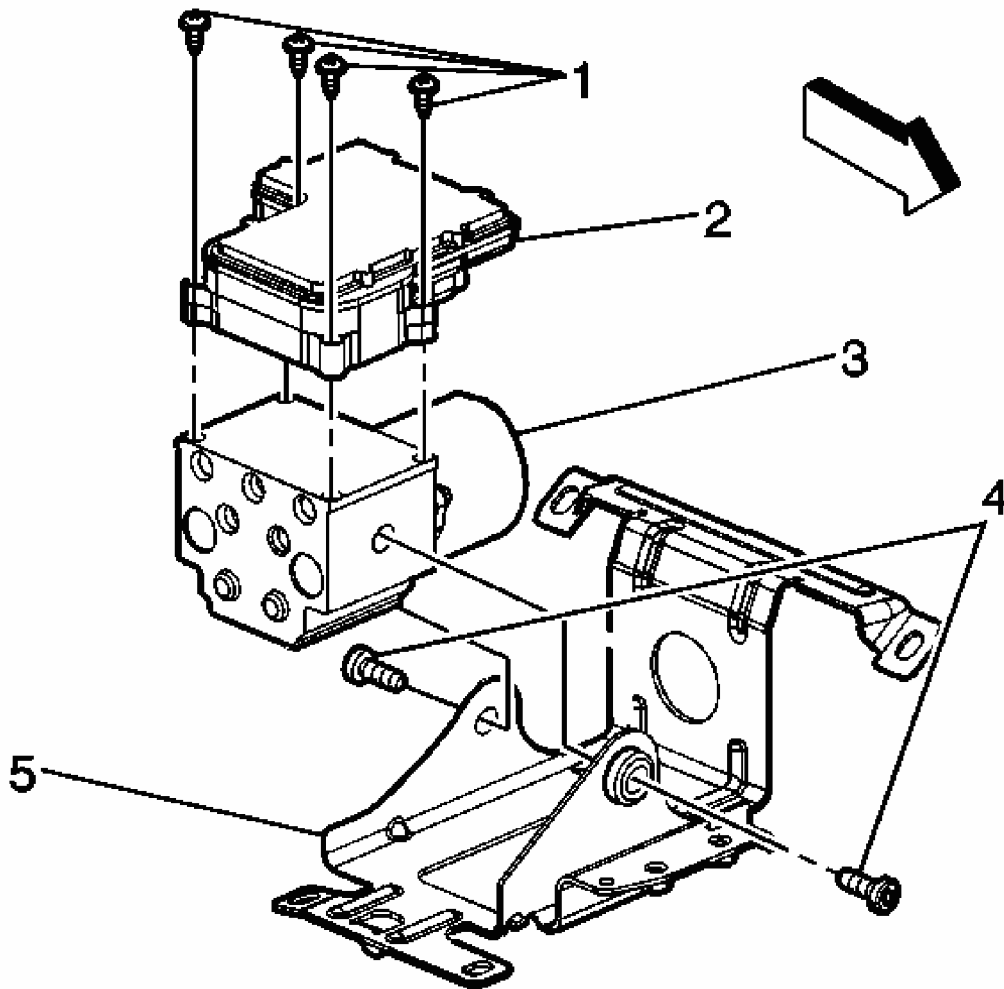


Fig. 9: Locating Electronic Brake Control Module Components
Courtesy of GENERAL MOTORS CORP.

1. Install EBCM (2) onto BPMV (3).

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NOTE: Refer to **Fastener Notice in Cautions and Notices.**

IMPORTANT: Do not reuse the old mounting bolts. Always install new bolts with the new BPMV.

2. Install the four EBCM bolts.

Tighten: Tighten the four bolts to 5 N.m (39 lb in) in an X-pattern.

3. Connect the 2 way ABS pump motor connector to the EBCM (2).
4. Install BPMV (3) to EHCUC bracket (5).
5. Connect the two electrical harness connectors to the EBCM (2).

IMPORTANT: The brake pipes are held in the proper place by a frame mounted plastic bracket. Make sure that the brake pipes stay in the correct place for proper reassembly.

6. Install the 5 brake pipes to the BPMV (3).

Tighten: Tighten the brake pipe fittings to 30 N.m (22 lb ft).

7. Bleed the brake system. Refer to ABS Automated Bleed Procedure .

WHEEL SPEED SENSOR REPLACEMENT (4WD PICKUP)

Removal Procedure

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information
2. Remove tire and wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
3. Remove brake caliper. Refer to Brake Caliper Replacement - Front (Dual Piston) in Disc Brakes.
4. Remove the hub and rotor. Refer to Brake Rotor Replacement - Front in Disc Brakes.
5. Remove wheel speed sensor mounting clip on the control arm.
6. Remove wheel speed sensor mounting clip on the frame rail.

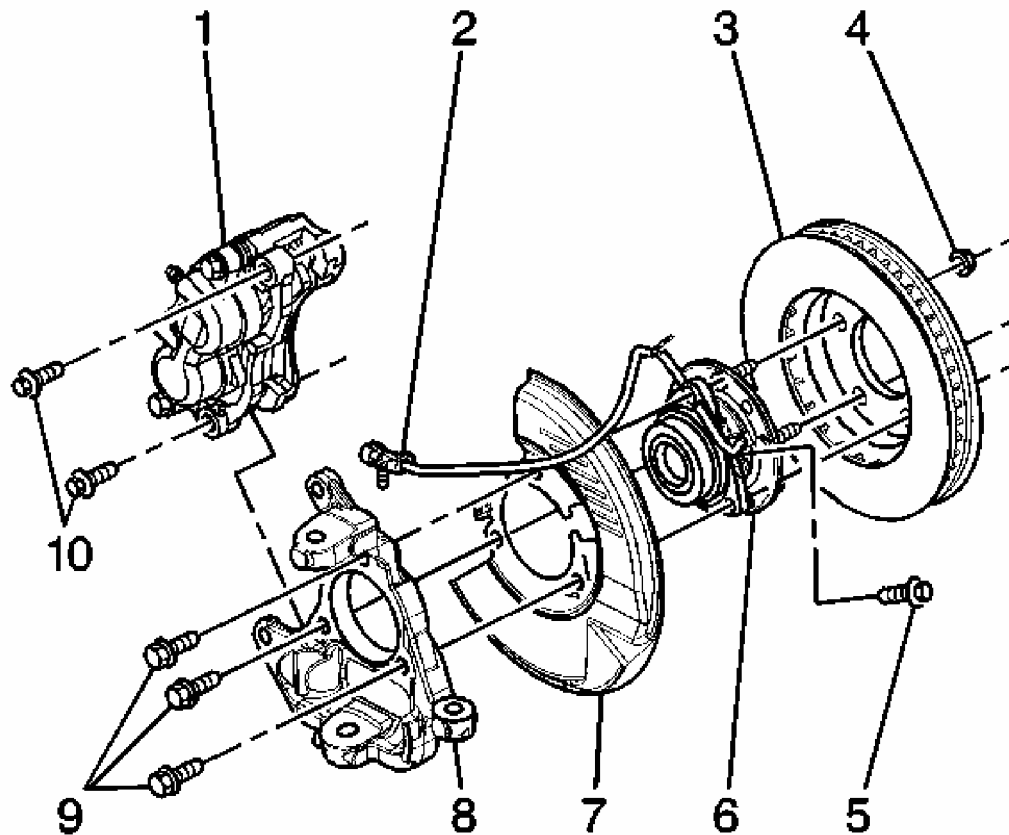


Fig. 10: Locating Wheel Speed Sensor (4WD Pickup)
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the wheel speed sensor electrical connector (2).
8. Remove the sensor mounting screw (5).

NOTE: Carefully remove the sensor by pulling it straight out of the bore. **DO NOT** use a screwdriver, or other device. Prying will cause the sensor body to break off in the bore.

NOTE: Do not attempt to remove the stainless steel shim from the bearing assembly. The shim is permanently attached. If the shim is damaged or bent, replace the bearing assembly. Failure to comply will result in diminished sensor and ABS performance.

IMPORTANT: The wheel speed sensor mounts into a bore that leads to

9. Remove wheel speed sensor from hub and bearing assembly.

Installation Procedure

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: The new speed sensor will have a new O-ring. Dispose of the old O-ring. Lubricate the new O-ring lightly with bearing grease prior to installation. You may also lubricate the sensor just above and below the new O-ring. **DO NOT** lubricate the bore.

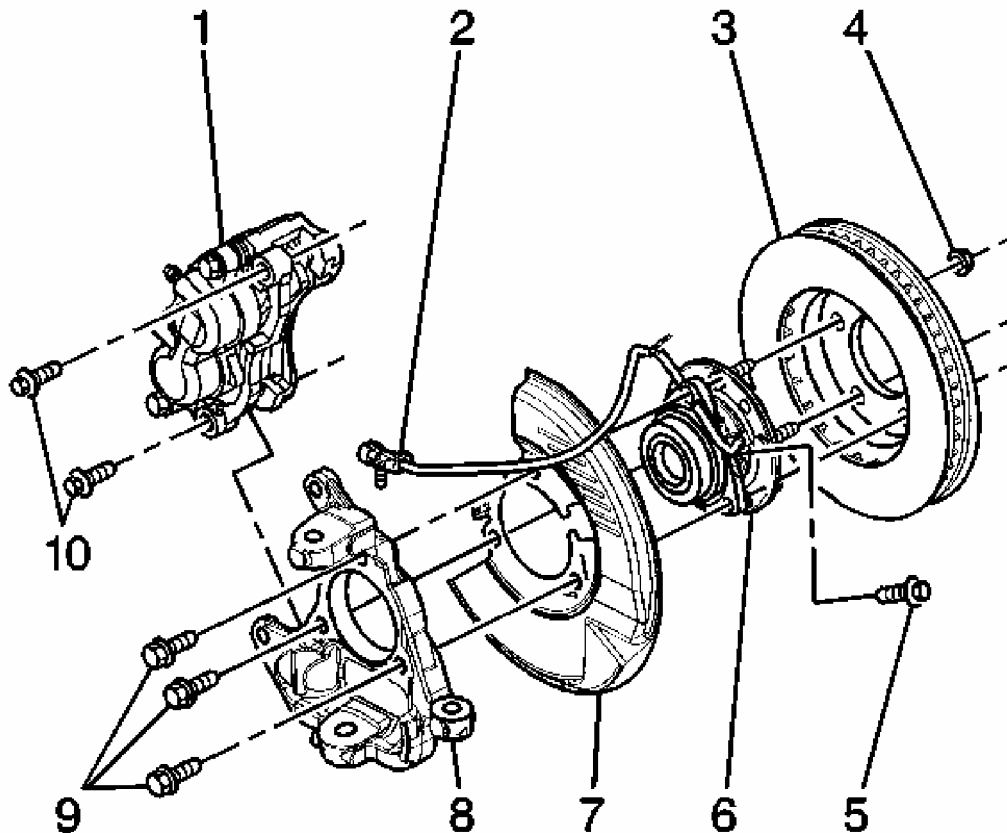


Fig. 11: Locating Wheel Speed Sensor (4WD Pickup)

Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The new sensor has new mounting clips already installed on the wire. DO NOT reuse the old clips.

1. Install sensor into the hub and bearing assembly (6).

Tighten: Tighten the sensor mounting screw (5) to 18 N.m (13 lb ft).

2. Connect the wheel speed sensor electrical connector (2).
3. Install wheel speed sensor mounting clip to the frame rail.
4. Install the wheel speed sensor mounting clip to the control arm.
5. Install the hub and rotor. Refer to **Brake Rotor Replacement - Front** in Disc Brakes.
6. Install brake caliper. Refer to **Brake Caliper Replacement - Front (Dual Piston)** in Disc Brakes.
7. Install tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information

WHEEL SPEED SENSOR REPLACEMENT (RWD PICKUP)

Removal Procedure

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove brake caliper. Refer to **Brake Caliper Replacement - Front (Dual Piston)** in Disc Brakes.
4. Remove the hub and rotor. Refer to **Brake Rotor Replacement - Front** in Disc Brakes.

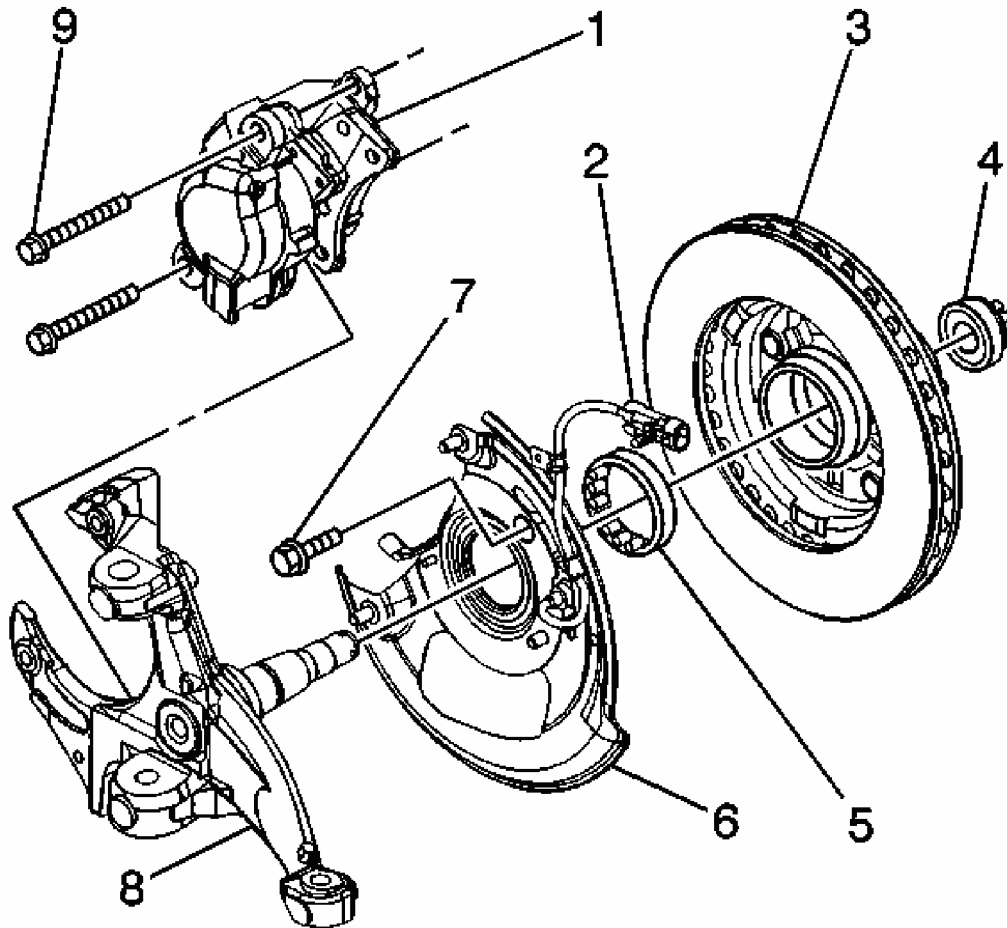


Fig. 12: Locating Wheel Speed Sensor (RWD Pickup)
Courtesy of GENERAL MOTORS CORP.

5. Remove wheel speed sensor cable electrical connector (2).
6. Remove 13 mm bolt and nut fastening the wheel speed sensor harness clip to the front side of the upper control arm.
7. Remove clips from the wheel speed sensor wire. Save the clips for the sensor wire.
8. Remove two 13 mm wheel speed sensor mounting bolts (7).
9. Remove two 11 mm splash shield mounting bolts.
10. Remove wheel speed sensor and splash shield assembly (6).
11. Remove splash shield gasket.
12. Clean gasket and knuckle surfaces thoroughly with a dry cloth.

1. Install splash shield gasket.

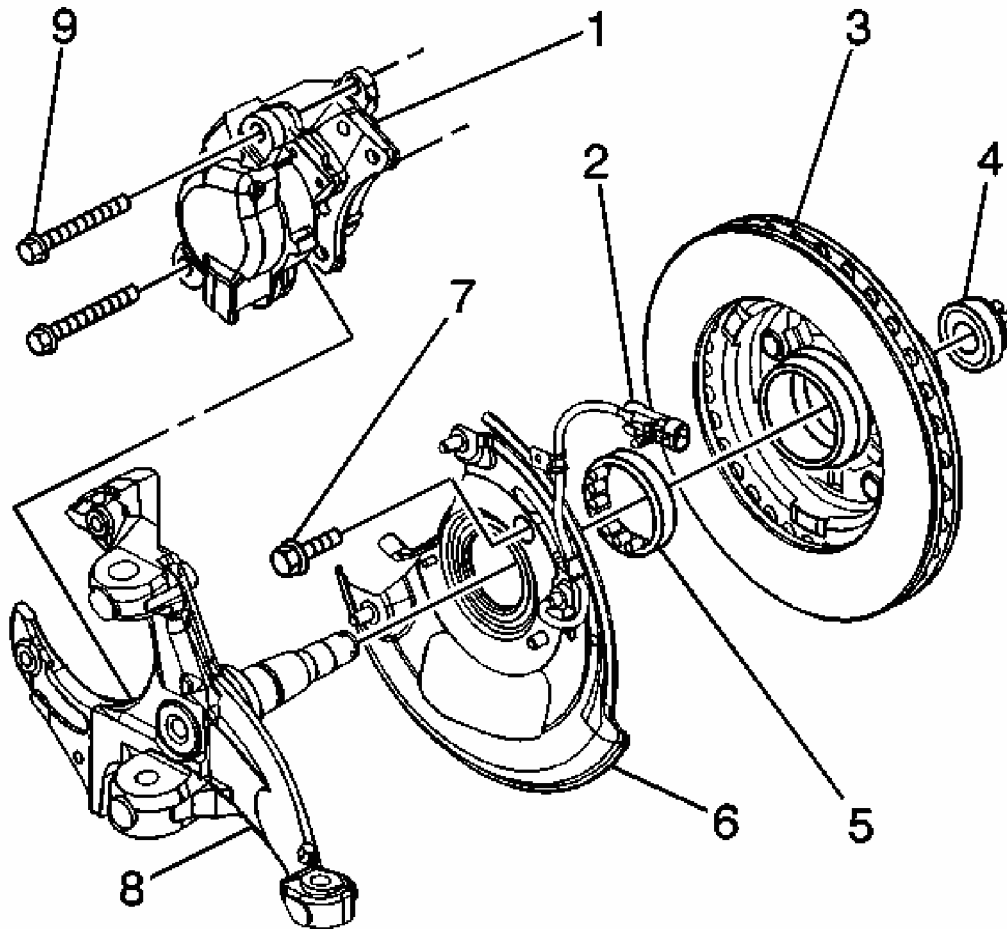


Fig. 13: Locating Wheel Speed Sensor (RWD Pickup)
Courtesy of GENERAL MOTORS CORP.

2. Install wheel speed sensor and splash shield assembly (6).

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install two 11 mm splash shield mounting bolts.

Tighten:

- Tighten the splash shield mounting bolts to 26 N.m (19 lb ft).
- Tighten the speed sensor mounting bolts to 18 N.m (13 lb ft).

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4. Install harness clips to the wheel speed sensor wire.
5. Locate the clip directly centered over the white paint mark on the wheel speed sensor cable.
6. Install harness clips and 13 mm fastening bolt and nut to the front side of the upper control arm
7. Install the hub and rotor. Refer to **Brake Rotor Replacement - Front** in Disc Brakes.
8. Install brake caliper. Refer to **Brake Caliper Replacement - Front (Dual Piston)** in Disc Brakes.
9. Install tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
10. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

WHEEL SPEED SENSOR REPLACEMENT (RWD UTILITY)

Removal Procedure

CAUTION: Refer to **Brake Dust Caution** in Cautions and Notices.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Remove tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
3. Remove brake caliper. Refer to **Brake Caliper Replacement - Front (Dual Piston)** in Disc Brakes.
4. Remove the hub and rotor. Refer to **Brake Rotor Replacement - Front** in Disc Brakes.
5. Remove wheel speed sensor mounting clip on the control arm.
6. Remove wheel speed sensor mounting clip on the frame rail.

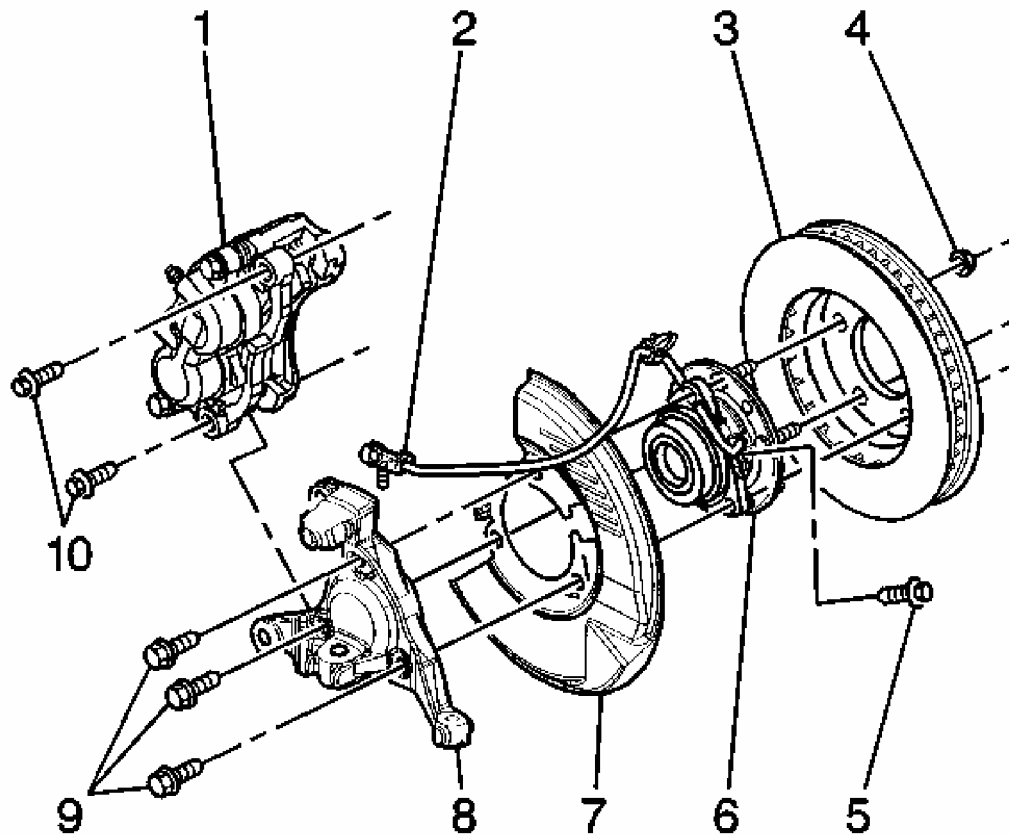


Fig. 14: Locating Wheel Speed Sensor (RWD Utility)
Courtesy of GENERAL MOTORS CORP.

7. Disconnect wheel speed sensor electrical connector (2).
8. Remove the sensor mounting screw (5).

NOTE: Carefully remove the sensor by pulling it straight out of the bore. **DO NOT** use a screwdriver, or other device. Prying will cause the sensor body to break off in the bore.

NOTE: Do not attempt to remove the stainless steel shim from the bearing assembly. The shim is permanently attached. If the shim is damaged or bent, replace the bearing assembly. Failure to comply will result in diminished sensor and ABS performance.

IMPORTANT: The wheel speed sensor mounts into a bore that leads to

the center of the sealed bearing. Use caution when cleaning or working around the bore. Do not contaminate the lubricant inside the sealed bearing. Failure to do so can lead to premature bearing failure.

9. Remove wheel speed sensor from hub and bearing assembly (5).

Installation Procedure

NOTE: Refer to Fastener Notice in Cautions and Notices.

IMPORTANT: The new speed sensor will have a new O-ring. Dispose of the old O-ring. Lubricate the new O-ring lightly with bearing grease prior to installation. You may also lubricate the sensor just above and below the new O-ring. DO NOT lubricate the bore.

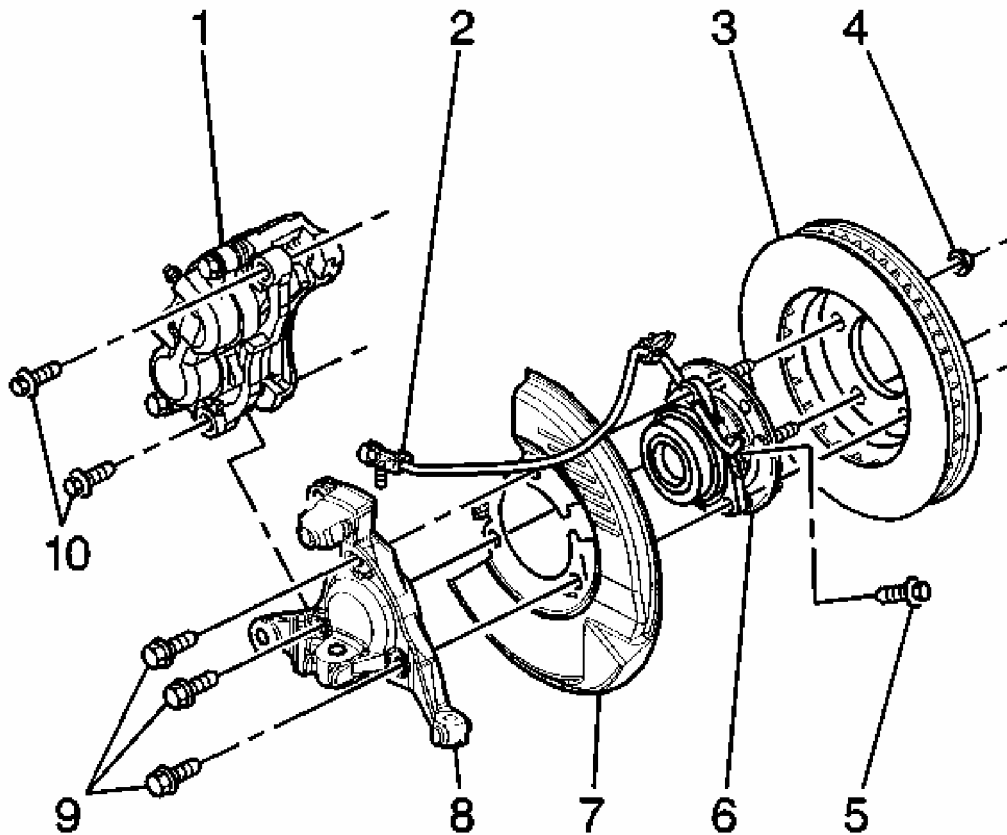


Fig. 15: Locating Wheel Speed Sensor (RWD Utility)

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Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The new sensor has new mounting clips already installed on the wire. DO NOT reuse the old clips.

1. Install sensor into the hub and bearing assembly (6).

Tighten: Tighten the sensor mounting screw (5) to 18 N.m (13 lb ft).

2. Connect the wheel speed sensor electrical connector (2).
3. Install wheel speed sensor mounting clip to the frame rail.
4. Install the wheel speed sensor mounting clip to the control arm.
5. Install the hub and rotor. Refer to **Brake Rotor Replacement - Front** in Disc Brakes.
6. Install brake caliper. Refer to **Brake Caliper Replacement - Front (Dual Piston)** in Disc Brakes.
7. Install tire and wheel. Refer to **Tire and Wheel Removal and Installation** in tires and Wheels.
8. Lower the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

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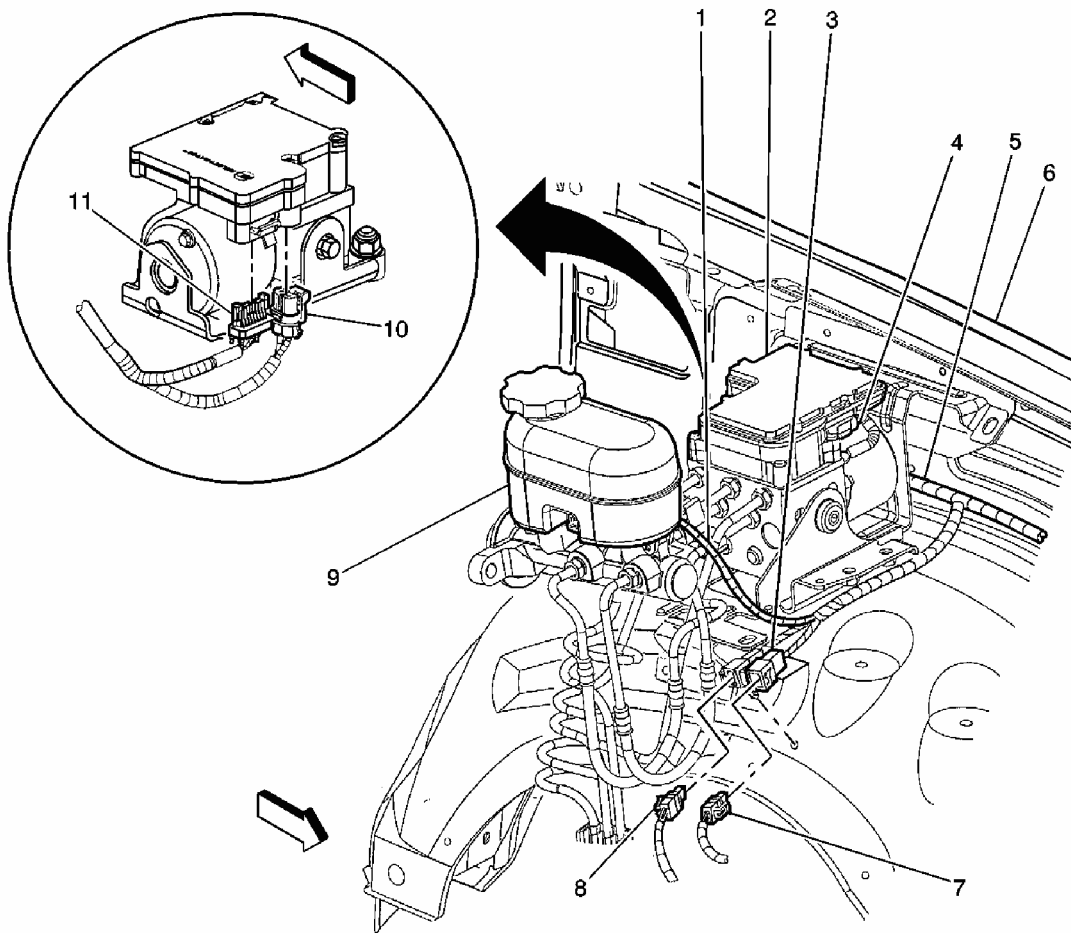


Fig. 16: Electronic Brake Control Module (EBCM)
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 16

Callout	Component Name
1	Brake Fluid Level Switch Connector
2	Electronic Brake Control Module (EBCM)
3	C114
4	Pump Motor
5	Body Harness
6	LF Fender
7	C114
8	C109
9	Brake Master Cylinder
10	Electronic Brake Control Module (EBCM) Connector C2
11	Electronic Brake Control Module (EBCM) Connector C1

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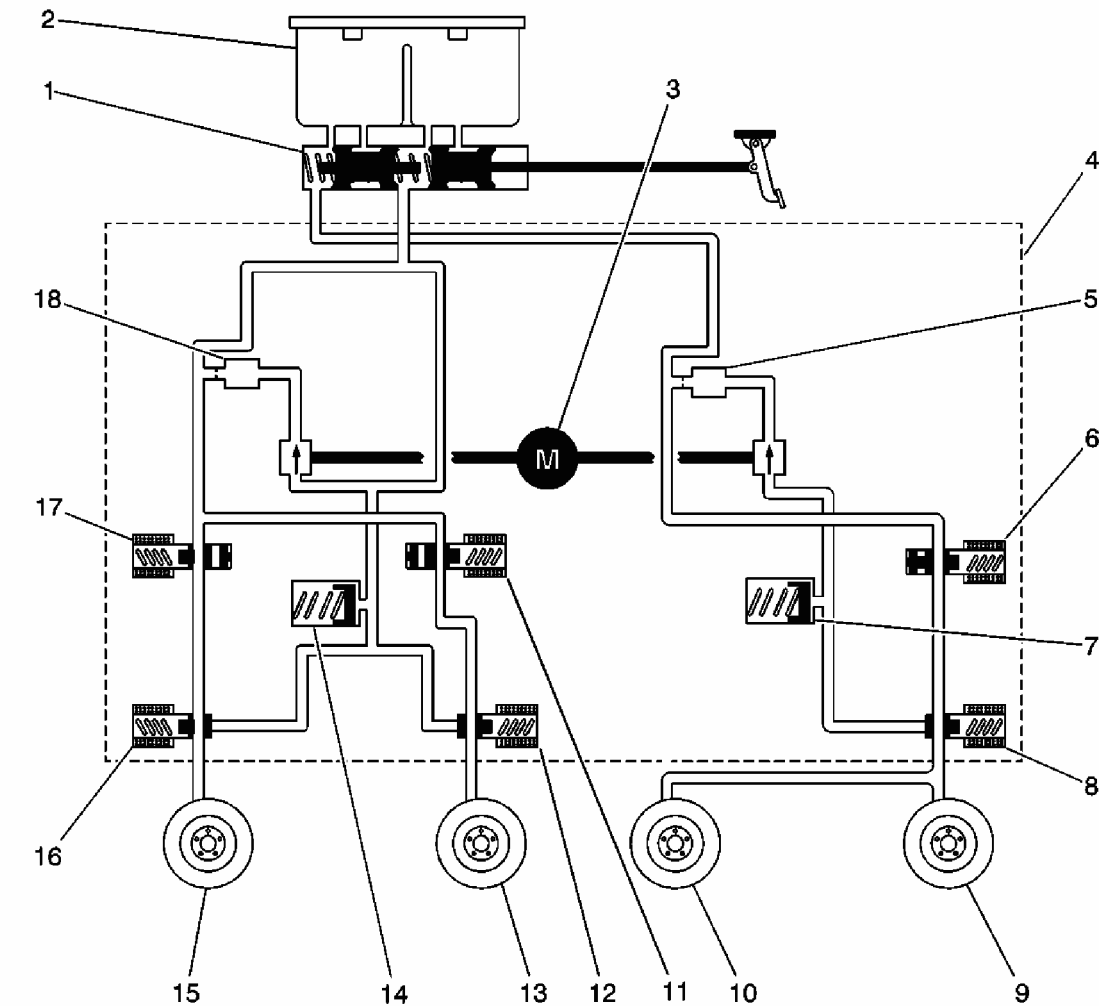


Fig. 17: BPMV Hydraulic Flow Diagram
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 17

Callout	Component Name
1	Master Cylinder
2	Master Cylinder Reservoir
3	Pump
4	Brake Pressure Modulator Valve (BPMV)
5	Damper
6	Rear Isolation Valve
7	Accumulator
8	Rear Dump Valve
9	Right Rear Brake
10	Left Rear Brake

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11	Left Front Isolation Valve
12	Left Front Dump Valve
13	Left Front Brake
14	Accumulator
15	Right Front Brake
16	Right Front Dump Valve
17	Right Front Isolation Valve
18	Damper

This vehicle is equipped with the Kelsey-Hayes EBC325 anti-lock braking system.

The vehicle is equipped with the following braking enhancement systems:

- Anti-lock Brake System (ABS)
- Dynamic Rear Proportioning (DRP)

The following components are involved in the operation of the above systems:

- Electronic Brake Control Module (EBCM) - The EBCM controls the system functions and detects failures.

The EBCM contains the following components:

- System Relay - The system relay is internal to the EBCM. The system relay is energized when the ignition is ON. The system relay supplies battery positive voltage to the solenoid valves and to the pump motor. This voltage is referred to as system voltage.
- Solenoids - The solenoids are commanded by the EBCM to operate the appropriate valves in the brake pressure modulator valve.
- Brake Pressure Modulator Valve (BPMV) - The BPMV uses a 3-circuit configuration to control the left front wheel, the right front wheel, and the combined rear wheels. The BPMV directs fluid to the left front and right front wheels independently. The BPMV directs fluid to the two rear wheels on a single hydraulic circuit.

The BPMV contains the following components:

- Pump Motor
- Three isolation valves (one for each hydraulic circuit)
- Three dump valves (one for each hydraulic circuit)
- A front low-pressure accumulator
- A rear low-pressure accumulator
- Wheel Speed Sensors (WSS) - As the front wheels spin, a toothed ring located at each

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wheel hub interrupts a magnetic field in the wheel speed sensors. This causes the wheel speed sensors to generate an AC signal. The EBCM uses this AC signal to calculate the wheel speed. The wheel speed sensors are replaceable only as part of the wheel hub and bearing assemblies. Any imperfections in the toothed ring, such as a missing or damaged tooth, can cause an inaccurate WSS signal.

- Vehicle Speed Sensor (VSS) - The input signal for rear wheel speed originates with the VSS. The Powertrain Control Module (PCM) receives rear wheel speed information from the VSS and supplies this information to the EBCM via a serial data message.

Initialization Sequence

The EBCM performs one initialization test each ignition cycle. The initialization of the EBCM occurs when the following conditions are met:

- The ignition is ON.
- The bulb check has been completed.
- Vehicle speed is greater than 6 km/h (4 mph).

The initialization sequence briefly cycles each solenoid and the pump motor to verify proper operation of the components. The EBCM sets one or more DTCs in accordance with any malfunction that is detected.

The EBCM defines a drive cycle as the completion of the initialization sequence.

Anti-lock Brake System

When wheel slip is detected during a brake application, the ABS enters anti-lock mode. During anti-lock braking, hydraulic pressure in the individual wheel circuits is controlled to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold, or increase hydraulic pressure to each wheel brake. The ABS cannot, however, increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking.

During anti-lock braking, a series of rapid pulsations is felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the EBCM responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pedal pulsations are present only during anti-lock braking and stop when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During anti-lock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during anti-lock operation.

Vehicles equipped with ABS may be stopped by applying normal force to the brake pedal. Brake pedal operation during normal braking is no different than that of previous non-ABS systems. Maintaining a constant force on the brake pedal provides the shortest stopping

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distance while maintaining vehicle stability.

Pressure Hold

The EBCM closes the isolation valve and keeps the dump valve closed in order to isolate the slipping wheel when wheel slip occurs. This holds the pressure steady on the brake so that the hydraulic pressure does not increase or decrease.

Pressure Decrease

If a pressure hold does not correct the wheel slip condition, a pressure decrease occurs. The EBCM decreases the pressure to individual wheels during deceleration when wheel slip occurs. The isolation valve is closed and the dump valve is opened. The excess fluid is stored in the accumulator until the pump can return the fluid to the master cylinder or fluid reservoir.

Pressure Increase

After the wheel slip is corrected, a pressure increase occurs. The EBCM increases the pressure to individual wheels during deceleration in order to reduce the speed of the wheel. The isolation valve is opened and the dump valve is closed. The increased pressure is delivered from the master cylinder.

Dynamic Rear Proportioning (DRP)

The dynamic rear proportioning (DRP) is a control system that replaces the hydraulic proportioning function of the mechanical proportioning valve in the base brake system. The DRP control system is part of the operation software in the EBCM. The DRP uses active control with existing ABS in order to regulate the vehicle's rear brake pressure.

The red brake warning indicator is illuminated when the dynamic rear proportioning function is disabled.

Brake Warning Indicator

The instrument panel cluster (IPC) illuminates the brake warning indicator when the following occurs:

- The body control module (BCM) detects that the park brake is engaged. The IPC receives a class 2 message from the BCM requesting illumination.
- The EBCM detects a low brake fluid condition and sends a class 2 message to the IPC.
- The IPC performs the bulb check.
- An ABS-disabling malfunction also disables dynamic rear proportioning (DRP).

ABS Indicator

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The IPC illuminates the ABS indicator when the following occurs:

- The electronic brake control module (EBCM) detects an ABS-disabling malfunction. The IPC receives a class 2 message from the EBCM requesting illumination.
- The IPC performs the bulb check.
- The IPC detects a loss of class 2 communications with the EBCM.